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OF THE

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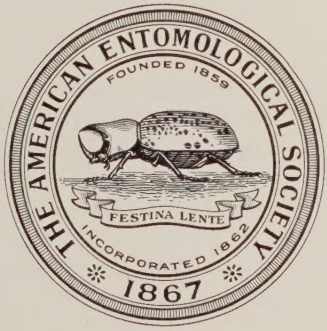

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LIST OF PAPERS

Burks (B. D.)
A Revision of the Genus Brachymeria Westwood in America North of Mexico (Hymenoptera: Chalcididae) 225

(Issued December 15, 1960)

Fox (Richard M.)
A Monograph of the Ithomiidae (Lepidoptera). Part II. The Tribe Melinaeini Clark 109

(Issued August 19, 1960)

Hoffman (Richard L.) and William T. Keeton
A List of the Generic Names Proposed in the Diplopod Order Spirobolida, with Their Type Species 1

(Issued March 25, 1960)

Krombein (Karl V.)
Additions to the Amiseginae and Adelphinae (Hymenoptera: Chrysididae) 27

(Issued May 11, 1960)

Rehn (James A. G.) and Harold J. Grant, Jr.
A New Concept Involving the Subfamily Acridinae (Orthoptera: Acridoidea) 173

(Issued August 19, 1960)

Roache (Lewie C.)
A Revision of the North American Elaterid Beetles of the Tribe Elaterini (Coleoptera: Elateridae) 275

(Issued March 8, 1961)

Roback (Selwyn S.)
Results of the Catherwood Peruvian-Amazon Expedition. New Species of South American Tendipedidae (Diptera) 87

(Issued August 19, 1960)

THEW (THOMAS B.)
Revision of the Genera of the Family Caenidae (Ephemeroptera) 187

(Issued September 16, 1960)

THOMPSON (W. R.)
The Larval Morphology of Some Tachinid Parasites of Diatraea (Diptera) 207

(Issued October 31, 1960)

VALENTINE (BARRY D.)
The Genera of the Weevil Family Anthribidae North of Mexico (Coleoptera) 41

(Issued June 17, 1960)

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VOLUME LXXXVI

A LIST OF THE GENERIC NAMES PROPOSED IN THE DIPLOPOD ORDER SPIROBOLIDA, WITH THEIR TYPE SPECIES

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Systematists are on occasion inclined to look with some disdain on the formalized manipulation of nomenclature and the involved rules which have grown around it, yet even the workers least interested in such legalities must admit that no classification can be better than the stability of its names. The charge is often made by taxonomists that zoologists in other fields of investigation frequently study animals in total ignorance of their correct identities, yet more than a few taxonomists have published extensive monographs with flagrant disregard for the most basic concepts of priority, genotypy, and like matters.

Such a deplorable state is nowhere better illustrated than in the Diplopoda, several outstanding students of which never followed nomenclatorial rules farther than the limits of personal convenience. With the unduly long era of wholesale " alpha taxonomy " now in its wane, and some efforts at synthesis being made, we believe that no more fundamental information can be

offered than a consideration of the proposed generic names and their correct type species, information which we consider basic to the work of synthesis which is now beginning. The importance of this purely bibliographic research is obvious, not only for its nomenclatorial interest, but also for providing lists of existing generic names many of which are often unknown to the investigator who may not have access to the extensive and widely scattered literature.

Becoming independently interested in spiroboloid millipeds, we have been impressed with the need for extensive systematic work on the order which they comprise, and present the following treatment as a step toward eventual monographic revision. Silvestri's list of 1896 (Ann. Mus. civ. Stor. nat. Genova, vol. 36, p. 174) admitted eight generic names for spiroboloids; that of Attems in 1926 (Handbuch der Zoologie, pp. 225, 226) included 58, but did not include many which Attems considered junior synonyms or of dubious status. Our listing accounts for 151 names. Of these, 144 were proposed between 1820 and 1959; the remaining seven are introduced in this paper as replacements for preoccupied names or as validations of improperly proposed ones.

No attempt is made to provide a breakdown of the names by families, for the reason that existing knowledge of this order is totally inadequate for the definition of families aside from the few which we have recently studied critically. The families recognized by Attems in his 1926 treatment are chaotically heterogeneous and meaningless.

In accordance with the provisions of the International Rules of Zoological Nomenclature, we recognize that generic and subgeneric names have the same standing in matters of priority and availability, and make no distinction between them in the listing. We have made no attempt to indicate subjective synonymy, nor in any other way to comment on zoological validity; only nomenclatorial validity as affected by homonymy or objective synonymy is of concern to us here. In most instances no mention of erroneous spellings is made, though such errors are not rare in the literature. We have endeavored to make the list as independent as possible, by introducing citations to (1) the original description of the generic name, (2) the original description of the type spe-

cies, when it was described earlier than the genus, and (3) the publications in which subsequent selections of types have been made.

Partially in the interests of space economy and partially because of the logic of the system, we adopt three designations to indicate the method of genotypy, namely (1) Orthotype, to cover all cases in which the type species was designated by the author in the original publication—in this category we recognize the combination "n. gen., n. sp." as well as such expressions as "gegrundet auf . . . ", as constituting original designation; (2) Haplotype, for instances in which but a single species name was included with the new generic name and no formal designation of a type was made; and (3) Logotype, which is invoked whenever the type species has been selected, *from the originally included names,* by an author in a subsequent publication. The listing of a genero-type by one of its senior synonyms is of course invalid, a distinction not generally made by our predecessors and colleagues.

In addition to the literature references, we have included a statement of the number of originally included species, as well as reference to the country or state of origin of the type species. This latter item is designed to be of limited use only, and is not to be construed a statement of the actual range of either the type species or the genus.

With respect to methodology, we have used three sources: search of the Zoological Record; reference to the lists of names given in such works as Attems' (1926) in the Handbuch der Zoologie; and finally, careful cross-reference from as many publications as we could find. Each name has been checked through the standard nomenclators (such as those of Neave and the Prussian Academy) and more than a few cases of preoccupation thus determined. Several minor errors have been noted in Neave's Nomenclator Zoologicus and are here categorized to be available for future inclusion.

Omitted.—Acladocricus Brölemann, 1913; *Apeuthes* Attems, 1938; *Bukobolus* Attems, 1914; *Centrobolus* Cook, 1896; *Epibolus* Cook, 1896; *Plokamostrophus* Chamberlin, 1921 (erroneously considered identical with *Plokamostrophus* Chamberlin, 1920); *Strophobolus* Chamberlin, 1920.

Credited to J. Carl instead of O. F. Cook.—*Hadrobolus* Cook, 1896; *Pachybolus* Cook, 1896.

Misspelled.—*Alcimobolus* as "*Alcimbolus*".

Misplaced as to group.—*Erythroprosopon* Verhoeff, 1938, placed in "Arach." instead of "Myr."; *Narceus* Rafinesque, 1820, placed in "Pisces" instead of "Myr."; *Rhexenor* Rafinesque, 1820, placed in "Pisces" instead of "Myr."

The status of the generic name Thrinciulus Porat, 1894.—*Thrinciulus* has been a source of some confusion and difficulty, affecting the taxonomic as well as nomenclatorial status of the genus, but we feel that the matter has now been solved with some finality.

The name was originally proposed by Porat in 1895 (Bih. svenska Vetensk. Akad., vol. 20, no. 4, pt. 5, p. 54) to include *T. multicostis* and *T. laevicollis,* both new species from West Africa, and *Acanthiulus murrayi* Pocock, 1893, from India. None of these three was designated as type.

Shortly afterward, O. F. Cook (Brandtia, p. 6, 1896) stated categorically that Porat had designated *murrayi* as type, and that the name *Thrinciulus* thereby became referable to the spiroboloid group. The genus was heterogeneous to begin with, as *T. multicostis* is actually a spirostreptoid and *laevicollis* a spiroboloid. Cook, therefore, correctly allocated *multicostis* to his family "Trachystreptidae", making it type of the new genus *Porostreptus.* Although Cook was mistaken in claiming that Porat had designated a type species for *Thrinciulus,* his comment itself constitutes a designation, and would have fixed *Thrinciulus* as a spiroboloid genus.

However, Cook's paper was published in May of 1896, and in March of the same year, Silvestri (Ann. Mus. civ. Stor. nat. Genova, vol. 36, p. 174) had already validly designated *multicostis* as type of *Thrinciulus.* The genus, with its junior objective synonym *Porostreptus* (NEW SYNONYMY), is therefore referable to the order Spirostreptida and is of no further interest to us at the present.

The generic names published by Attems, 1953.—In a posthumously published article on myriapods from Indochina (1953, Mem. Mus. nat. de Hist. nat., Paris, N.S., Ser. A, vol. 5, pp. 133–199), Count Attems introduced four new generic and three new

sub-generic names for spiroboloid groups. Type species were designated for three of the genera, but for the four remaining names, which were proposed as new in the body of identification keys, we are told only the number of included species, with no mention of any by name. *Florianus, Arisemus, Decelus,* and *Gonauchenius* are, therefore, invalidly proposed and are without standing. Two courses have been available: to discard the names altogether or to validate them by the designation of type species. The latter alternative seems preferable, and fortunately it is possible to select the species which Count Attems probably had in mind in setting up the categories.

Florianus, proposed for two species, occurs as a new genus in a key to the genera of the family Trigoniulidae. Two species of *Trigoniulus* (in the old, broad sense) have been described from the island of Flores, and since these key out correctly it seems likely that *Florianus* was erected for them. We have selected one of these species and thereby introduce *Florianus* into the literature as a new genus.

The other three names, proposed as subgenera of *Trigoniulus,* are identified in much the same way. Here, however, we are referred at the outset to a key to the species of *Trigoniulus* published by Attems in 1932. He states " Hier trenne ich eine neue Gattung *Florianus* für 2 bisher als *Trigoniulus* gefuhrte Arten ab. Den verbleibenden Rest verteile ich auf 6 Subgenera. Die Genera *Sumatrobolus* Verh. und *Ainigmobolus* Verh. glaubte ich besser als Subgenera von *Trigoniulus* zu nehmen. Von den Subgenera enthalten *Decelus, Gonauchenius,* und *Ainigmobolus* nur je eine Art, es sind etwas aberrante Formen."

By comparison of the keys in the 1932 and 1953 papers, with the appropriate eliminations, we have been able to arrive with some confidence at the species which must have inspired the various names.

The authors of spiroboloid genera.—Compilation of a list such as this, presumably complete for an entire order, provides the opportunity for summary of various more or less incidental information which is none the less of rather general interest. One compilation which seems worthy of presentation is a breakdown

of the numbers of generic names proposed by the different authors. This, of course, gives no idea of the validity of the names but indicates the degree of activity, as well as a glimpse of the taxonomic philosophy, of most of the leading workers in the past!

45	R. V. Chamberlin, and collaborators
16	Karl W. Verhoeff
12	Carl G. Attems
12	Orator F. Cook
11	Johann Carl
11	Filippo Silvestri
10	Henri W. Brölemann
7	R. Innes Pocock
5	H. F. Loomis
15	by 9 other authors with fewer than 5 genera each
7	new here
151	

Alphabetical List of Generic Names

Acanthiulus Gervais 1844, Ann. Sci. nat., Paris, Zool., ser. 3, vol. 2, p. 70.

Monobasic.

Orthotype.—Julus blainvillii LeGuillou, 1841 (Compt. rend. Acad. Sci. Paris, vol. 13, p. 221), from New Guinea.

Acladocricus Brölemann, 1913, Rec. Australian Mus., vol. 10, p. 123.

Monobasic.

Orthotype.—Rhinocricus pyrrholoma Attems, 1897 (Abh. Senckenberg. naturf. Ges., vol. 23, p. 527), from Celebes.

Adelobolus Verhoeff, 1924, Arkiv Zool., vol. 16, no. 5, p. 109.

Proposed for two new species.

Logotype.—Adelobolus simplex Verhoeff, 1924, from Queensland; by present designation.

Ainigmabolus Verhoeff, 1937, Rec. Australian Mus., vol. 20, p. 148.

Monobasic with a new species.

Haplotype.—Ainigmabolus chisholmi Verhoeff, 1937, from Australia.

Alcimobolus Loomis, 1936, Bull. Mus. Comp. Zool., vol. 80, p. 56.

Monobasic with a new species.

Orthotype.—Alcimobolus angustipes Loomis, 1936, from Haiti.

Allopocockia Brölemann, 1913, Bull. Soc. ent. France, p. 478.

Monobasic.

Orthotype.—Spirobolellus tylopus Pocock, 1908 (Biol. Centr.-Amer., Chil. and Dipl., p. 87), from Guatemala.

Also described as new by Brölemann, 1914 (Ann. Soc. ent. France, vol. 83, p. 34), with the same type species.

Amblybolus Cook, 1896, Brandtia, p. 58. *Nomen nudum* [see validation by Keeton, in press].

Monobasic with a new species name.

Haplotype.—Amblybolus mitis Cook, 1896, a *nomen nudum.*

Cook gave no valid "indication" for either the genus or its single included species. They must, therefore, be regarded as *nomina nuda* at present. A validating description by Keeton is now in press.

Amnestostrophus, new name.

Proposed with three species.

Orthotype.—Plokamostrophus mindanaonus Chamberlin, 1921 (Ann. Mag. Nat. Hist., ser. 9, vol. 7, p. 73), from the Philippine Islands.

This name replaces *Plokamostrophus* Chamberlin, 1921 (op. cit., p. 73), proposed for two new species from the Philippines and one from Guam, but preoccupied by *Plokamostrophus* Chamberlin, 1920, proposed for species from Melanesia with *P. amphelictus* Chamberlin as orthotype.

Anadenobolus Silvestri, 1897, Ann. Mus. civ. Stor. nat. Genova, vol. 38, p. 651.

Monobasic.

Orthotype.—Spirobolus politus Porat, 1888 (Ann. Soc. Ent. Belgique, vol. 32, p. 243), from Antigua.

Andocricus Chamberlin, 1955, Bull. Univ. Utah, biol. ser., vol. 11, no. 5, p. 9.

Monobasic with a new species.

Orthotype.—Andocricus harae Chamberlin, 1955, from Peru.

Anelus Cook, 1911, Proc. U. S. Nat. Mus., vol. 40, p. 160.

Proposed with two species.

Orthotype.—Anelus reduncus Cook, 1911, from Texas.

Apeuthes Attems, 1938, Mem. Mus. nat. de Hist. nat., Paris, N. S., vol. 6, p. 256.

Proposed for three new species.

Logotype.—Eucarlia (*Apeuthes*) *maculata* Attems, 1938, from Annam, Indochina; by present designation.

Aphistogoniulus Silvestri, 1897, Ann. Mus. civ. Stor. nat. Genova, vol. 38, p. 651.

Monobasic with a new species.

Orthotype.—Trigoniulus sanguinemaculatus Silvestri, 1897 (Abh. Mus. Dresden, vol. 6, no. 9, p. 18), from Madagascar.

Aporobolus Loomis, 1934, Smithsonian Misc. Coll., vol. 89, no. 14, p. 23.

Monobasic with a new species.

Orthotype.—Aporobolus crusoi Loomis, 1934, from Tobago.

Arctobolus Cook, 1904, Harriman Alaska Exped., vol. 8, p. 64.

Proposed with two species.

Orthotype.—Arctobolus onondaga Cook, 1904, from New York.

Argentocricus Verhoeff, 1941, Arch. Naturgesch., N. F., vol. 10, p. 298.

Monobasic with a new species.

Haplotype.—Argentocricus nobilis Verhoeff, 1941, from Argentina.

Arinolus Chamberlin, 1940, Journ. Ent. Zool. Pomona College, vol. 32, p. 81.

Monobasic with a new species.

Orthotype.—Arinolus torynophor Chamberlin, 1940, from Arizona.

Arisemus, new genus.

Proposed with two species.

Orthotype.—Trigoniulus tamicus Attems, 1914 (Arch. Naturg., vol. 80, Abt. A, Heft 4, p. 349), from New Guinea.

This genus also includes *Trigoniulus ralumensis* Attems, 1914 (op. cit., p. 348).

See page 4 for a discussion of this name as invalidly (no included species) proposed by Attems, 1953 (p. 188), as a subgenus of *Trigoniulus*. Comparison of Attems' two keys indicates that the type of *Arisemus* is in a section of the 1932 key which includes eight species. Five of these are in the subgenus *Trigoniulus*, according to the 1953 key, and one is the type of *Sumatrobolus;* this leaves only *tamicus* and *ralumensis*.

Arolus Chamberlin, 1922, Proc. U. S. Nat. Mus., vol. 60, art. 8, p. 34.

Monobasic with a new species.

Orthotype.—Arolus purulanus Chamberlin, 1922, from Guatemala.

Arostrophus Chamberlin, 1920, Bull. Mus. Comp. Zool., vol. 64, p. 228.

Proposed with two species.

Orthotype.—Trigoniulus mertoni Carl, 1912 (Abh. Senckenberg. naturf. Ges., vol. 34, p. 273), from the Aru Islands.

Atopetholus Chamberlin, 1918, Proc. Biol. Soc. Washington, vol. 31, p. 167.

Proposed for three new species.

Orthotype.—Atopetholus californicus Chamberlin, 1918, from California.

Atopochetus Attems, 1953, Mem. Mus. nat. de Hist. nat., Paris, N. S., ser. A, vol. 5, pp. 180, 191.

Monobasic with a new species.

Orthotype.—Atopochetus rubrodorsalis Attems, 1953, from Cambodia.

Attemsobolus Verhoeff, 1924, Arkiv Zool., vol. 16, no. 5, p. 100.

Monobasic with a new species.

Haplotype.—Attemsobolus bivittatus Verhoeff, 1924, from Queensland.

Aulacobolus Pocock, 1903, Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 530.

Monobasic.

Orthotype.—Spirobolus urocerus Pocock, 1892 (Journ. Royal Asiatic Soc., Bombay Branch, vol. 7, p. 169), from Madras.

Auxobolus Chamberlin, 1949, Journ. Washington Acad. Sci., vol. 39, p. 163.

Proposed with eight species.

Orthotype.—Auxobolus ergus Chamberlin, 1949, from California.

Aztecolus Chamberlin, 1943, Bull. Univ. Utah, biol. ser., vol. 8, no. 3, p. 28.

Monobasic.

Orthotype.—Spirobolus nigrior Chamberlin, 1941 (Ent. News, vol. 52, p. 253), from Nuevo Leon, Mexico.

Azygobolus Loomis, 1934, Smithsonian Misc. Coll., vol. 89, no. 14, p. 25.

Monobasic with a new species.

Orthotype.—Azygobolus tumidus Loomis, 1934, from St. Martin's Island, West Indies.

Banosolus Wang, 1951, Serica, vol. 1, pp. 24, 28.

Monobasic with a new species.

Orthotype.—Banosolus philippinus Wang, 1951, from the Philippine Islands.

Barrobolus Chamberlin, 1925, Proc. Biol. Soc. Washington, vol. 38, p. 41.

Monobasic with a new species.

Orthotype.—Barrobolus grammicus Chamberlin, 1925, from Panama.

Brachyspirobolus Carl, 1914, in Brölemann, Ann. Soc. ent. France, vol. 83, p. 34.

Proposed with two species.

Logotype.—Microspirobolus aequatorialis Carl, 1909 (Rev. Suisse Zool., vol. 17, p. 354), from Central Africa; by designation of Brölemann 1914 (op. cit., p. 34).

This name was proposed as a substitute for *Microspirobolus* Carl, 1909, which is preoccupied by *Microspirobolus* Silvestri, 1898. Carl formally published *Brachyspirobolus* in the fall of 1914 (Mem. Soc. neuchatel. Sci. nat., vol. 5, p. 873), but he had previously communicated his intention of doing so to Brölemann, who published the name in the spring of 1914. Brölemann clearly states, however, that the name was coined by Carl and furnished to him. We prefer, therefore, to credit the name to Carl and date it from the earlier publication. It thus has priority over *Bukobolus* Attems, 1914, which was not published until June, and which was also proposed as a substitute name for *Microspirobolus* Carl. (We wish to acknowledge with appreciation the aid of Dr. Ralph E. Crabill Jr. and of Dr. Otto Kraus in determining the dates of publication of the three 1914 papers.)

Brölemann's statement that he had examined " le type de son genre, *M. aequatorialis* " seems to be the only published mention of a type species of *Microspirobolus* Carl or of either of its two substitute names. This we consider to constitute a valid designation of a logotype for *Microspirobolus*. Both *Brachyspirobolus* Carl and *Bukobolus* Attems automatically take the type of the name for which they were proposed as replacements.

Bukobolus Attems, 1914, Arch. Naturg., vol. 80, Abt. A, Heft 4, p. 297.

Proposed with two species.

Logotype.—Microspirobolus aequatorialis Carl, 1909 (Rev. Suisse Zool., vol. 17, p. 354), from Central Africa; by designation of Brölemann 1914 (Ann. Soc. ent. France, vol. 83, p. 34).

This name was proposed as a substitute for *Microspirobolus* Carl, 1909, which is preoccupied. *Brachyspirobolus* Carl, 1914, was published earlier as a substitute for *Microspirobolus*, however, and *Bukobolus* thus becomes a junior objective synonym of that name. See both *Brachyspirobolus* and *Microspirobolus* Carl.

Cairibolus Chamberlin, 1918, Bull. Mus. Comp. Zool., vol. 62, p. 209.

Proposed for two new species.

Orthotype.—Cairibolus antonianus Chamberlin, 1918, from Jamaica.

Californibolus Verhoeff, 1944, Bull. So. California Acad. Sci., vol. 43, p. 53.

Monobasic with a new species.

Haplotype.—Californibolus michelbacheri Verhoeff, 1944, from California.

Callipodolus, new name.

Monobasic.

Orthotype.—Spirobolus pulchripes Gerstäcker, 1873 (in Van der Decken's Reisen in Ostafrika, vol. 3, pt. 2, p. 515), from Mombasa.

This name replaces *Epibolus* Cook, 1897 (Brandtia, p. 75), proposed for *pulchripes*, but preoccupied by *Epibolus* Fleming, 1822, a generic name in Pisces.

Centrelus Cook, 1911, Proc. U. S. Nat. Mus., vol. 40, p. 154.

Monobasic with a new species.

Orthotype.—Centrelus falcatus Cook, 1911, from Guanajuato, Mexico.

Centrobolus Cook, 1897, Brandtia, p. 74.

Monobasic.

Orthotype.—Spirobolus luctuosus Peters, 1855 (Monatsb. Akad. Wissensch. Berlin, p. 80), from Mozambique.

Chelogonobolus Carl, 1919, Rev. Suisse Zool., vol. 27, p. 399.

Monobasic.

Orthotype.—Spirobolus nahuus Saussure and Humbert, 1869 (Rev. et Mag. Zool., ser. 2, vol. 21, p. 154), from Mexico.

Chersastus Attems, 1926, Handb. der Zool., vol. 4, p. 196.

Monobasic.

Haplotype.—Trigoniulus braueri Attems, 1900 (Zool. Jahrb., Abt. Syst., Band 13, p. 159), from the Seychelles.

This genus is usually considered as dating from 1928 (Ann. S. Afr. Mus., vol. 26, p. 300) when first formally proposed for eleven species, seven of them new. However, it was validated by its publication in 1926 in a key to the genera of the Trigoniulidae. Although Attems there stated that the genus contains eleven species, only one was mentioned by name—and illustrated—and it thereby constitutes the haplotype of *Chersastus*.

Chicobolus Chamberlin, 1947, Proc. Acad. Nat. Sci. Philadelphia, vol. 99, p. 46.

Monobasic with a new species.

Orthotype.—Chicobolus pilsbryi Chamberlin, 1947, from Florida.

Cingalobolus Carl, 1918, Rev. Suisse Zool., vol. 26, p. 448.

Monobasic with a new species.

Haplotype.—Cingalobolus bugnioni Carl, 1918, from Ceylon.

Cladiscocricus Brölemann, 1913, Rec. Australian Mus., vol. 10, p. 123.

Monobasic.

Orthotype.—Rhinocricus falcatus Silvestri, 1897 (Abh. Mus. Dresden, vol. 6, no. 9, p. 6), from Queensland.

Cubobolus Chamberlin 1918, Bull. Mus. Comp. Zool., vol. 62, p. 206.

Monobasic with a new species.

Orthotype.—Cubobolus beliganus Chamberlin, 1918, from Cuba.

Cubocricus Chamberlin, 1922, Proc. U. S. Nat. Mus., vol. 61, art. 10, p. 5.

Proposed for two species.

Orthotype.—Cubocricus suprenans Chamberlin, 1922, from Cuba.

Cyclothyrophorus Pocock, 1908, Biol. Centr.-Amer., Chilop. and Diplop., p. 83.

Proposed with four species.

Orthotype.—Cyclothyrophorus salvini Pocock, 1908, from Guerrero.

Decelus, new genus.

Monobasic.

Orthotype.—Trigoniulus brachysternus Attems, 1938 (Mem. Mus. nat. de Hist. nat., Paris, N. S., vol. 6, p. 254), from Annam.

See page 4 for a discussion of this name as invalidly (no included species) proposed by Attems, 1953 (p. 188).

Dekanbolus Verhoeff, 1938, Arch. Naturg., N. F., vol. 7, p. 629.

Monobasic with a new species.

Haplotype.—Dekanbolus rubellus Verhoeff, 1938, from India.

Desmocricellus Attems, 1953, Mem. Mus. nat. de Hist. nat., Paris, N. S., ser. A, vol. 5, p. 184.

Monobasic with a new species.

Orthotype.—Desmocricellus reischeki Attems, 1953, from New Zealand.

Desmocricus Carl, 1918, Rev. Suisse Zool., vol. 26, p. 445.

Monobasic with a new species.

Haplotype.—Desmocricus conjunctus Carl, 1918, from the Moluccas.

Diaphoropus Silvestri, 1897, Ann. Mus. civ. Stor. nat. Genova, vol. 38, p. 651.

Monobasic.

Orthotype.—Iulus carnifex Fabricius, 1775 (Syst. Ent., p. 428), from Tranquebar.

Preoccupied by *Diaphoropus* Bate, 1888 (Crustacea). See *Xenobolus*.

Dinematocricus Brölemann, 1913, Rec. Australian Mus., vol. 10, p. 122.

Proposed for six new species.

Orthotype.—Dinematocricus lanceolatus Brölemann, 1913, from New Ireland.

Epibolus Cook, 1897, Brandtia, p. 75.

Monobasic.

Orthotype.—Spirobolus pulchripes Gerstäcker, 1873 (in: Van der Decken's Reisen in Ostafrika, vol. 3, no. 2, p. 515), from Mombasa.

This name is preoccupied by *Epibolus* Fleming, 1822 (Pisces). See *Callipodolus*.

Epitrigoniulus Brölemann, 1903, Zool. Anz., vol. 26, p. 181.

Monobasic with a new species.

Haplotype.—Spirobolellus cruentatus Brölemann, 1903, thought to be from the Indo-malayan region.

Epombrophilus Attems, 1936, Mem. Indian Mus., vol. 11, p. 306.

Monobasic with a new species.

Orthotype.—Epombrophilus rufipes Attems, 1936, from India.

Erythroprosopon Verhoeff, 1936, Rec. Indian Mus., vol. 38, p. 503.

Monobasic with a new species.

Haplotype.—Erythroprosopon phoenix Verhoeff, 1936, from Madras, India.

Eucarlia Brölemann, 1913, Bull. Soc. ent. France, p. 478.

Monobasic.

Orthotype.—Trigoniulus velox Carl, 1912 (Abh. Senckenberg. naturf. Ges., vol. 34, p. 271), from the Aru Islands.

Also described as new by Brölemann, 1914 (Ann. Soc. ent. France, vol. 83, p. 33), with the same type species.

Eucentrobolus Pocock, 1903, Ann. and Mag. Nat. Hist., ser. 7 vol. 12, p. 528.

Monobasic with a new species.

Haplotype.—Eucentrobolus tamulus Pocock, 1903, from India.

Eurelus Cook, 1911, Proc. U. S. Nat. Mus., vol. 40, p. 151.

Monobasic with a new species.

Orthotype.—Eurelus soleatus Cook, 1911, from Texas.

Eurhinocricus Brölemann, 1903, Ann. Soc. ent. France, vol. 72, p. 131.

Monobasic with a new species.

Haplotype.—Rhinocricus (Eurhinocricus) biolleyi Brölemann, 1903, from the Cocos Islands.

Florianus, new genus.

Proposed with two species.

Orthotype.—Trigoniulus megaloproctus Pocock, 1894 (in Weber: Zool. Ergeb. Reise Niederl. Ost-Ind., vol. 3, no. 2, p. 397), from Flores.

This genus also includes *T. reconus* Pocock (op. cit., p. 396), also from Flores.

See page 4 for a discussion of this name as invalidly (no included species) proposed by Attems, 1953 (pp. 187, 188).

Floridobolus Causey, 1957, Proc. Biol. Soc. Washington, vol. 70, p. 206.

Monobasic with a new species.

Orthotype.—Floridobolus penneri Causey, 1957, from Florida.

Glosselus Cook, 1911, Proc. U. S. Nat. Mus., vol. 40, p. 163.

Proposed for two species.

Orthotype.—Glosselus musarum Cook, 1911, from Costa Rica.

Gonauchenius, new genus.

Monobasic.

Orthotype.—Trigoniulus ceramicus Attems, 1914 (Arch. Naturg., vol. 80, Abt. A, Heft 4, p. 339), from West Ceram.

See page 4 for a discussion of this name as invalidly (no included species) proposed by Attems, 1953 (p. 188).

The type species is usually considered as dating from 1915 (Bijdr. Dierk., vol. 20, p. 8) when first formally proposed. However, it was validated by its publication in 1914 in a key to species of *Trigoniulus*.

Gosichelus Chamberlin, 1949, Journ. Washington Acad. Sci., vol. 39, p. 168.

Proposed with two species.

Orthotype.—Onychelus medolus Chamberlin, 1941 (Bull. Univ. Utah, biol. ser., vol. 6, no. 4, p. 13), from Arizona.

Guamobolus Chamberlin, 1946, Proc. Biol. Soc. Washington, vol. 59, p. 161.

Monobasic with a new species.

Orthotype.—Guamobolus delus Chamberlin, 1946, from Guam.

Hadrobolus Cook, 1897, Brandtia, p. 73.

Monobasic.

Orthotype.—Spirobolus crassicollis Peters, 1855 (Monatsb. Königl. Akad. Wissensch., Berlin, p. 79), from Mozambique.

Hesperolus Chamberlin, 1918, Proc. Biol. Soc. Washington, vol. 31, p. 169.

Monobasic with a new species.

Orthotype.—Hesperolus wheeleri Chamberlin, 1918, from California.

Hiltonius Chamberlin, 1918, Proc. Biol. Soc. Washington, vol., 31, p. 166.

Monobasic with a new species.

Orthotype.—Hiltonius pulchrus Chamberlin, 1918, from California.

Howeobolus Verhoeff, 1928, Rec. Australian Mus., vol. 16, p. 107.

Monobasic with a new species.

Orthotype.—Howeobolus insularum Verhoeff, 1928, from Lord Howe Island, off New South Wales.

Designation of type was by use of the expression "gen. et sp. nov."

Incobolus Chamberlin, 1955, Bull. Univ. Utah, biol. ser., vol. 11, no. 5, p. 7.

Monobasic with a new species.

Orthotype.—Incobolus thaumastus Chamberlin, 1955, from Peru [sic].

Javolus Chamberlin, 1945, Amer. Mus. Nov., no. 1282, p. 20.

Monobasic with a new species.

Orthotype.—Javolus purmerendus Chamberlin, 1945, from Java.

Komphobolus Carl, 1941, Rev. Suisse Zool., vol. 48, p. 607.

Monobasic with a new species.

Haplotype.—Komphobolus mimicus Carl, 1941, from India.

Lankabolus Carl, 1941, Rev. Suisse Zool., vol. 48, p. 604.

Monobasic with a new species.

Haplotype.—Lankabolus coelebs Carl, 1941, from Ceylon.

Leiocricus Loomis, 1936, Bull. Mus. Comp. Zool., vol. 80, p. 50.

Monobasic with a new species.

Orthotype.—Leiocricus diversipes Loomis, 1936, from Hispaniola.

Leptogoniulus Silvestri, 1897, Ann. Mus. civ. Stor. nat. Genova, vol. 38, p. 651.

Monobasic.

Orthotype.—Trigoniulus acolastus Silvestri, 1897 (Ann. Soc. ent. Belgique, vol. 41, p. 354), from French Guiana.

Lissocricus Chamberlin, 1953, Amer. Midl. Nat., vol. 50, p. 141.

Monobasic with a new species.

Orthotype.—Lissocricus howlandi Chamberlin, 1953, from Colombia.

Litobolus Chamberlin, 1947, Proc. Acad. Nat. Sci. Philadelphia, vol. 99, p. 47.

Monobasic with a new species.

Orthotype.—Litobolus hanevavus Chamberlin, 1947, from the Marquesas Islands.

Litostrophus Chamberlin, 1921, Ann. and Mag. Nat. Hist., ser. 9, vol. 7, p. 72.

Monobasic with a new species.

Orthotype.—Litostrophus segregatus Chamberlin, 1921, from the "Gulf of Siam."

Marshallbolus Verhoeff, 1936, Trans. Sapporo Nat. Hist. Soc., vol. 14, p. 229.

Proposed for two species.

Orthotype.—Marshallbolus takakuwai Verhoeff, 1936, from the Marshall Islands.

The heading "*Marshallbolus* n. g. *takakuwai* n. sp." appears in the explanation of the illustrations of the species on page 234, and this we construe to be an original designation of the type species.

Mauritobolus Verhoeff, 1939, Jena Zeitschr. Naturw., vol. 73, heft 1, p. 72.

Monobasic with a new species.

Haplotype.—Mauritobolus fissus Verhoeff, 1939, from Mauritius.

Messicobolus Brölemann, 1913, Bull. Soc. ent. France, p. 477.

Monobasic.

Orthotype.—Spirobolus godmani Pocock, 1908 (Biol. Centr.-Amer., Chilop. and Diplop., p. 78), from Mexico.

Also described as new by Brölemann, 1914 (Ann. Soc. ent. France, vol. 83, p. 32), with the same type species.

Metacricus Chamberlin, 1953, Amer. Midl. Nat., vol. 50, p. 141.

Monobasic with a new species.

Orthotype.—Metacricus modestus Chamberlin, 1953, from Venezuela.

Metiche Attems, 1909, in Sjöstedt: Ergeb. Schwed. Exped. Kilimandjaro, vol. 3, no. 19, p. 25.

Monobasic.

Haplotype.—Trigoniulus bravensis Silvestri, 1897 (Ann. Mus. civ. Stor. nat. Genova, vol. 37, p. 307), from East Africa.

Kraus (1958, Veröff. Uberseemus. Bremen, ser. A, vol. 3, p. 6) points out that the specimens identified as *T. bravensis* by Attems in 1909 are not conspecific with Silvestri's types, and that *Metiche* is a genus based on a misidentified type species. Attems' material from Usambara is renamed by Kraus as *Metiche attemsi*. The type of the genus must, however, remain the species Attems *said* he had (i.e. *bravensis*), not the species he is now thought actually to have had.

Microspirobolus Silvestri, 1898, An. Mus. nac. Buenos Aires, vol. 6, p. 75.

Monobasic with a new species.

Haplotype.—Microspirobolus pulchellus Silvestri, 1898, from Venezuela.

Microspirobolus Carl, 1909, Rev. Suisse Zool., vol. 17, p. 354.

Proposed for two new species.

Logotype.—Microspirobolus aequatorialis Carl, 1909, from central Africa; by subsequent designation of Brölemann, 1914 (Ann. Soc. ent. France, vol. 83, p. 34).

This name is preoccupied by *Microspirobolus* Silvestri, 1898 (Diplopoda). See both *Brachyspirobolus* and *Bukobolus*.

Mystalides Attems, 1910, in Voeltzkow's Reise Ost-Afrika, vol. 3, no. 2, p. 94.

Proposed with five species, two of them new.

Logotype.—Mystalides quadridentatus Attems, 1910, from Madagascar; by present designation.

Narceus Rafinesque, 1820, Annals of Nature, p. 8.

Monobasic with a new species.

Haplotype.—Narceus tinctorius Rafinesque, 1820, from Kentucky.

Narcaeus Thorell, 1890 (Arachn.), must be considered a junior homonym of *Narceus* Rafinesque if " ae " and " e " are considered strictly equivalent.

Neocricus Chamberlin, 1941, Bull. Univ. Utah biol. ser., vol. 6, no. 4, p. 14.

Proposed with five species, three of them new.

Orthotype.—Neocricus foederatus Chamberlin, 1941, from Venezuela.

Neptunobolus Schubart, 1949, Mem. Inst. Butantan, vol. 21, p. 16.

Monobasic with a new species.

Orthotype.—Neptunobolus hogei Schubart, 1949, from islands off São Paulo, Brazil.

Nesobolus Chamberlin, 1918, Bull. Mus. Comp. Zool., vol. 62, p. 203.

Monobasic with a new species.

Orthotype.—Nesobolus toroanus Chamberlin, 1918, from Cuba.

Onychelus Cook, 1904, Harriman Alaska Exped., vol. 8, p. 64.

Monobasic with a new species.

Orthotype.—Onychelus obustus Cook, 1904, from California.

Opheocricus Verhoeff, 1938, Zool. Jahrb., Syst. Abt., vol. 71, p. 38.

Monobasic with a new species.

Orthotype.—Rhinocricus (Opheocricus) giganteus Verhoeff, 1938, from East Africa [sic].

Orthichelus Chamberlin and Hoffman, 1950, Chicago Acad. Sci., Nat. Hist. Misc., no. 71, p. 7.

Proposed with three species.

Orthotype.—Onychelus phanus Chamberlin, 1941 (Bull. Univ. Utah, biol. ser., vol. 6, no. 5, p. 6), from California.

Oxobolus Chamberlin, 1922, Proc. U. S. Nat. Mus., vol. 60, art. 8, p. 30.

Proposed for four new species.

Orthotype.—Oxobolus virilis Chamberlin, 1922, from Guatemala.

Oxypyge Silvestri, 1896, Boll. Mus. Zool. Anat. comp. Torino, vol. 11, no. 254, p. 4.

Monobasic with a new species.

Haplotype.—Oxypyge varicolor Silvestri, 1896, from Panama.

Oxypygides Chamberlin, 1922, Proc. U. S. Nat. Mus., vol. 60, art. 8, p. 24.

Proposed with two new species.

Orthotype.—Oxypygides mesites Chamberlin, 1922, from Guatemala.

Pachybolus Cook, 1897, Brandtia, p. 73.

Proposed with seven species, six of them new.

Orthotype.—Pachybolus tectus Cook, 1897, from Zanzibar.

Paraspirobolus Brölemann, 1902, Rev. Mus. Paulista, vol. 5, p. 183.

Monobasic with a new species.

Haplotype.—Paraspirobolus paulistus Brölemann, 1902, from Brazil.

Pentocricus Schubart, 1951, An. Acad. Brasileira Cienc., vol. 23, p. 231.

Monobasic.

Haplotype.—Rhinocricus quintiporus Attems, 1897 (Abh. Senckenberg. naturf. Ges., vol. 23, p. 524), from Halmahera.

An objective junior synonym of *Proporobolus* Silvestri, 1898. NEW SYNONYMY.

Perucricus Kraus, 1954, Senckenbergiana biol., vol. 35, p. 45.

Monobasic with a new species.

Orthotype.—Perucricus rostratus Kraus, 1954, from Peru.

Phagostrophus Chamberlin, 1920, Bull. Mus. Comp. Zool., vol. 64, p. 224.

Proposed with ten species, three of them new.

Orthotype.—Phagostrophus pertinens Chamberlin, 1920, from the Solomon Islands.

Physobolus Attems, 1936, Mem. Indian Mus., vol. 11, p. 301.

Monobasic with a new species.

Orthotype.—Physobolus olivaceus Attems, 1936, from India.

Piedolus Chamberlin, 1930, Pan-Pacific Ent., vol. 6, p. 117.

Monobasic with a new species.

Orthotype.—Piedolus utus Chamberlin, 1930, from Utah.

Plokamostrophus Chamberlin, 1920, Bull. Mus. Comp. Zool., vol. 64, p. 216.

Proposed with seven species, two of them new.

Orthotype.—Plokamostrophus amphelictus Chamberlin, 1920, from the Solomon Islands.

Plokamostrophus Chamberlin, 1921, Ann. and Mag. Nat. Hist., ser. 9, vol. 7, p. 73.

Proposed for three new species.

Orthotype.—Plokamostrophus mindanaonus Chamberlin, 1921, from the Philippine Islands.

This name is preoccupied by *Plokamostrophus* Chamberlin, 1920 (Diplopoda). See *Amnestostrophus*.

Polybunobolus Pocock, 1903, Ann. and Mag. Nat. Hist., ser. 7, vol. 12, p. 531.

Monobasic.

Orthotype.—Acanthiulus murrayi Pocock, 1893 (Ann. and Mag. Nat. Hist., ser. 6, vol. 11, p. 136), from the Aru Islands.

Polyconoceras Attems, 1914, Arch. Naturg., vol. 80, Abt. A, Heft 4, p. 309.

Proposed with numerous species and two new subgenera.

Orthotype.—Polyconoceras fossatus Attems, 1914, from New Guinea.

The species *Polyconoceras fossatus* was not formally described as new until 1915 (in: Nova Guinea, vol. 13, Zool., Livr. 1, p. 9), but in the 1914 publication the name appears in a key to species with sufficient information to validate it. The name *fossatus* (as well as other species names treated in the same manner in the two publications) must, therefore, be dated from 1914 and considered as originally included in the genus.

Poratobolus Verhoeff 1924, Ark. Zool., vol. 16, no., 5 p. 100.

Monobasic with a new species.

Haplotype.—Poratobolus mjöbergi Verhoeff, 1924, from Queensland.

Prionopeza Attems, 1953, Mem. Mus. nat. de Hist. nat. Paris, N. S., ser. A, vol. 5, p. 180.

Monobasic with a new species.

Orthotype.—Prionopeza serrulata Attems, 1953, from Queensland.

Proporobolus Silvestri, 1897, Ann. Mus. civ. Stor. nat. Genova, vol. 38, p. 651.

Monobasic.

Orthotype.—Rhinocricus quintiporus Attems, 1897 (Abh. Senckenberg. naturf. Ges., vol. 23, p. 524), from Halmahera.

See *Pentocricus*.

Prospirobolus Attems, 1910, in Voeltzkow's Reise Ostafrika, vol. 3, p. 90.

Monobasic.

Haplotype.—Spirobolus joannisi Brölemann, 1896, Mem. Soc. Zool. France, vol. 9, p. 359), from China.

See *Sinobolus*.

Pseudospirobolellus Carl 1912, Rev. Suisse Zool., vol. 20, p. 168.

Monobasic.

Haplotype.—Spirobolus bulbiferus Attems, 1903 (Zool. Jahrb., Abt. Syst., vol. 18, p. 71), from Java.

Pygodon Saussure and Zehntner, 1902, Abh. Senckenberg. naturf. Ges., vol. 26, p. 441.

Monobasic with a new species.

Haplotype.—Pygodon dorso-vittatum Saussure and Zehntner, 1902, from Nossi-bé.

Queenslandobolus Verhoeff, 1924, Ark. Zool., vol. 16, no. 5, p. 100.

Monobasic with a new species.

Haplotype.—Queenslandobolus sjöstedti Verhoeff, 1924, from Queensland.

Rhexenor Rafinesque, 1820, Annals of Nature, p. 8.

Monobasic with a new species.

Haplotype.—Rhexenor annularis Rafinesque, 1820, from New York.

Rhinocricus Karsch, 1881, Zeitschr. Naturwiss., vol. 54, p. 68.

Proposed with 17 species.

Logotype.—Rhinocricus parcus Karsch, 1881, from Porto Rico; by subsequent designation of Pocock, 1894 (Journ. Linnean Soc. London, Zool., vol. 24, p. 485).

In 1914 (Arch. Naturgesch., vol. 80, A 4, p. 307), Attems invalidly cites *Rhinocricus Beauforti* Att. as "typus" of *Rhinocricus* in a strict sense.

The generic name was consistently misspelled "*Rhinocrinus*" in all of the publications of C. H. Bollman (assembled in U. S. Nat. Mus. Bull. 46, 1893).

Rhytidocricus, new name.

Monobasic.

Orthotype.—Rhinocricus diversicauda Silvestri, 1896 (Boll. Mus. Torino, vol. 11, no. 254, p. 3), from Ecuador.

This name replaces *Trachyrhinus* Silvestri, 1897, proposed for *diversicauda* but preoccupied twice.

Saipanella Chamberlin, 1945, Proc. Biol. Soc. Washington, vol. 58, p. 34.

Monobasic with a new species.
Haplotype.—Saipanella marianna Chamberlin, 1945, from Saipan.

This genus was described in another order, but it is clearly a member of the Spirobolida, probably closely related to *Pseudospirobolellus*.

Salpidobolus Silvestri, 1897, Ann. Mus. civ. Stor. nat. Genova, vol. 38, p. 651.

Monobasic.
Orthotype.—Rhinocricus meyeri Silvestri, 1897 (Abh. Mus. Dresden, vol. 6, no. 9, p. 8), from Celebes.

Saussurobolus Carl, 1919, Rev. Suisse Zool., vol. 27, p. 389.

Proposed with two species, one of them new.
Orthotype.—Iulus nietanus Saussure, 1860 (Mem. Soc. Phys. et Hist. nat. Genève, vol. 15, pt. 2, p. 565), from Mexico.

Schmidtolus Chamberlin, 1953, Amer. Midl. Nat., vol. 50, p. 149.

Proposed for two new species.
Orthotype.—Schmidtolus chichivacus Chamberlin, 1953, from Guatemala.

Scobinomus Loomis, 1953, Journ. Washington Acad. Sci., vol. 43, p. 420.

Monobasic with a new species.
Orthotype.—Scobinomus serratus Loomis, 1953, from Baja California.

Sechellobolus Brölemann, 1913, Bull. Soc. ent. France, p. 478.

Monobasic.
Orthotype.—Spirobolus teledapus Attems, 1900 (Zool. Jahrb., Abt. Syst., vol. 13, p. 155), from the Seychelles Islands.
Also described as new by Brölemann, 1914 (Ann. Soc. ent. France, vol. 83, p. 32), with the same type species.

Sinobolus Chamberlin and Wang, 1953, Amer. Mus. Novitates, no. 1621, p. 12.

Monobasic.
Orthotype.—Spirobolus joannsi (*sic*—lapsus for *joannisi*) Brölemann, 1896 (Mem. Soc. Zool. France, vol. 9, p. 359), from China.

A junior objective synonym of *Prospirobolus* Attems, 1910.

Spirobolellus Pocock, 1894, in Weber, Ergeb. Reise Niederl. Ost-Ind., vol. 3, no. 2, p. 391.

Proposed with three new species, one established species, and three others provisionally included.

Orthotype.—Spirobolellus chrysodirus Pocock, 1894, from Sumatra.

Spirobolinus Silvestri, 1898, Boll. Mus. Zool. Anat. Comp. Torino, vol. 13, no. 324, p. 8.

Proposed for two new species.

Logotype.—Spirobolinus luciae Silvestri, 1898, from Ecuador; by subsequent designation of Hoffman, 1955 (Proc. Biol. Soc. Washington, vol. 68, p. 152).

Spirobolus Brandt, 1833, Bull. Soc. Imp. Nat. Moscou, vol. 6, p. 202.

Proposed for two new species.

Logotype.—Spirobolus bungi Brandt, 1833, from China; by subsequent designation of Pocock, 1894 (in Weber: Zool. Ergeb. Reise Niederl. Ost.-Ind., vol. 3, no. 2, p. 388).

Wang (1951, Serica, vol. 1, p. 24) states that "Spirobolus marginatus Say" is the type species of this genus, and cites H. C. Wood as the author of the genus with 1865 as date of publication—a comedy of errors!

Spiromanes Saussure and Zehntner, 1902, in Grandidier, Hist. phys. nat. Madagascar, vol. 27, pp. 114, 122.

Proposed with three species.

Logotype.—Spirobolus seychellarum Saussure and Zehntner, 1897 (op. cit., vol. 27, Atlas, pl. X, fig. 36), from the Seychelles Islands; by present designation.

Spiromimus Saussure and Zehntner, 1902, Abh. Senckenberg. naturf. Ges., vol. 26, pp. 441, 443.

Proposed for two new species.

Logotype.—Spiromimus univirgatus Saussure and Zehntner, 1901, from Madagascar; by present designation.

Spirostrophus Saussure and Zehntner, 1902, in Grandidier, Hist. phys. nat. Madagascar, vol. 27, pp. 114, 150.

Proposed with two species.

Logotype.—Spirobolus naresii Pocock, 1893 (Ann. and Mag. Nat. Hist., ser. 6, vol. 11, p. 252), from the Seychelles Islands; by subsequent designation of Brölemann, 1914 (Ann. Soc. ent. France, vol. 83, p. 14).

Stenobolus Carl 1918, Rev. Suisse Zool., vol. 26, p. 452.

Monobasic with a new species.

Haplotype.—Stenobolus insularis Carl, 1918, from Male Atoll. Maldive Islands.

Strophobolus Chamberlin, 1920, Proc. Biol. Soc. Washington, vol. 33, p. 37.

Proposed for two new species.

Orthotype.—Strophobolus immigrans Chamberlin, 1920, from "California on Stag-Horn Fern from Australia."

Sumatrobolus Verhoeff, 1938, Zool. Jahrb., Abt. Syst., vol. 71, p. 44.

Monobasic.

Orthotype.—Trigoniulus squamifer Attems, 1930 (Arch. Hydrobiol., vol. 8, p. 149), from Sumatra.

Sympastrophus Chamberlin, 1920, Bull. Mus. Comp. Zool., vol. 64, p. 232.

Monobasic with a new species.

Orthotype.—Sympastrophus manokwarinus Chamberlin, 1920, from Dutch New Guinea.

Tarascolus Chamberlin, 1943, Bull. Univ. Utah, biol. ser., vol. 8, no. 3, p. 25.

Proposed for two new species.

Orthotype.—Tarascolus bolivari Chamberlin, 1943, from Michoacan.

Thyroproctus Pocock, 1894, Journ. Linnean Soc. London, Zool., vol. 24, pp. 485, 506.

Monobasic with a new species.

Orthotype.—Thyroproctus townsendi Pocock, 1894, from Jamaica.

Sometimes spelled "*Thyrhoproctus*" in the older literature.

Tidolus Chamberlin, 1949, Journ. Washington Acad. Sci., vol. 39, p. 169.

Monobasic.

Orthotype.—Atopetholus parvus Chamberlin, 1918 (Proc. Biol. Soc. Washington, vol. 31, p. 168), from California.

Titsonobolus Chamberlin, 1920, Univ. California Publ. Zool., vol. 19, p. 395.

Monobasic with a new species.

Orthotype.—Titsonobolus uncopygus Chamberlin, 1920, from India.

Toltecolus Chamberlin, 1943, Bull. Univ. Utah, biol. ser., vol. 8, no. 3, p. 27.

Monobasic with a new species.

Orthotype.—Toltecolus garcianus Chamberlin, 1943, from Nuevo Leon.

Tonkinbolus Verhoeff, 1938, Zool. Jahrb., Abt. Syst., vol. 71, p. 35.

Monobasic with a new species.

Haplotype.—Tonkinbolus scaber Verhoeff, 1938, from China.

Trachelomegalus Silvestri 1896, Ann. Mus. civ. Stor. nat. Genova, vol. 36, p. 27.

Proposed with four species.

Logotype.—Spirobolus hoplurus Pocock, 1893 (Ann. and Mag. Nat. Hist., ser. 6, vol. 11, p. 252), from Borneo; by subsequent designation of Silvestri, 1896 (Ann. Mus. civ. Stor. nat. Genova, vol. 36, p. 174).

Trachyrhinus Silvestri, 1897, Ann. Mus. civ. Stor. nat. Genova, vol. 38, p. 651.

Monobasic.

Orthotype.—Rhinocricus diversicauda Silvestri, 1896 (Boll. Mus. Torino, vol. 11, no. 254, p. 3), from Ecuador.

This name is preoccupied by *Trachyrhinus* Weed, 1892 (Arachnida), and *Trachyrhinus* Sharp, 1896 (Coleoptera). See *Rhytidocricus*.

Trigoniulus Pocock, 1894, Journ. Linnean Soc. London, Zool., vol. 24, p. 484.

Monobasic.

Orthotype.—Spirobolus goesi Porat, 1876 (Bih. Sv. Vet. Akad. Handl., vol. 4, no. 7, p. 36), from St. Barthelemy and Java.

Several authors have stated that the type species of this genus is *Spirobolus lumbricinus* Gerstäcker, 1873, generally considered a senior synonym of *goesi*.

Trucobolus Chamberlin, 1947, Ent. News, vol. 58, p. 41.

Monobasic with a new species.

Orthotype.—Trucobolus townesi Chamberlin, 1947, from Truk Atoll. Caroline Islands.

Tylobolus Cook, 1904, Harriman Alaska Exped., vol. 8, p. 65.

Monobasic with a new species.

Orthotype.—Tylobolus deses Cook, 1904, from California.

Variulus Wang, 1951, Serica, vol. 1, pp. 24, 34.

Monobasic with a new species.

Orthotype.—Variulus mindanaonus Wang, 1951, from the Philippine Islands.

Walesbolus Verhoeff, 1928, Rec. Australian Mus., vol. 16, pp. 105, 106.

Monobasic with a new species.

Orthotype.—Walesbolus lobatus Verhoeff, 1928, from New South Wales.

Designation of type was by use of the expression "gen. et sp. nov."

Watichelus Chamberlin, 1949, Journ. Washington Acad. Sci., vol. 39, p. 169.

Monobasic.

Orthotype.—Onychelus smithi Chamberlin, 1947 (Proc. Acad. Nat. Sci. Philadelphia, vol. 99, p. 49), from California.

Xenobolus Carl, 1919, Rev. Suisse Zool., vol. 27, p. 393.

Monobasic.

Orthotype.—Iulus carnifex Fabricius, 1775 (Syst. Entomol., p. 428), from India.

The generic name *Diaphoropus Silvestri,* 1897, with the same type species, is older than *Xenobolus* but is preoccupied.

Yucatobolus Chamberlin, 1938, Publ. Carnegie Inst., no. 491, p. 173.

Monobasic with a new species.

Orthotype.—Yucatobolus spukilensis Chamberlin, 1938, from Yucatan.

Zipyge Chamberlin, 1925, Proc. Biol. Soc. Washington, vol. 38, p. 40.

Monobasic.

Orthotype.—Oxypyge ferruginipes Chamberlin, 1922 (Proc. U. S. Nat. Mus., vol. 60, art. 8, p. 27), from Guatemala.

Zygostrophus Chamberlin, 1920, Bull. Mus. Comp. Zool., vol. 64, no. 1, p. 228.

Proposed with five species, three of them new.

Orthotype.—Zygostrophus ferruginops Chamberlin, 1920, from Queensland.

Addendum

After this paper had gone to press, the authors discovered a major error in the treatment of *Thrinciulus.* Porat (1894) did not, as we indicated, designate a type species on pages 54–56 where *Thrinciulus* was described. But he *did* designate *Acanthiulus murrayi* as type of this genus earlier in his paper in the discussion of *Acanthiulus.* Thus Cook was correct, and we were wrong. Readers are therefore asked to disregard the subsection of the present paper dealing with "The Status of the Generic Name *Thrinciulus* Porat, 1894."

Thrinciulus must now be regarded as a generic name in the Spirobolida. Silvestri's designation of *multicostis* as type is invalid, and *Porostreptus* is thus not a synonym of *Thrinciulus. Polybunobolus* Pocock, 1903, becomes a junior objective synonym of *Thrinciulus,* **NEW SYNONYMY.**

Thrinciulus, should be inserted in this generic list (making the total 152 names), with treatment as follows:

Thrinciulus Porat, 1894, Bih. Kongl. Svenska Vet.-Akad., Band 20, Afd. 4, No. 5, p. 52.

Proposed with three species, two of them new.

Orthotype.—Acanthiulus murrayi Pocock, 1893 (Ann. Mag. Nat. Hist., ser. 6, vol. 11, p. 136), from the Aru Islands.

See *Polybunobolus*.

ADDITIONS TO THE AMISEGINAE AND ADELPHINAE (HYMENOPTERA, CHRYSIDIDAE)

BY KARL V. KROMBEIN

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Some additional material has accumulated since publication of my generic reclassification [1] of these wasps. The following notes are presented so that a name will be available for use in a paper by D. J. Pirone on the life history and behavior of an adelphine egg parasite of the walking stick *Anisomorpha ferruginea* (Beauv.).

I am indebted to C. Besuchet, K. W. Cooper, D. J. Pirone, and H. K. Townes for the donation or loan of material used in the present study. J. M. McGough sent collection notes on the specimen for which a new genus and species are described below. D. J. Pirone has kindly allowed me to make a brief summary of the life history from his extensive notes on the new adelphine egg parasite.

Amiseginae

Mesitiopterus kahlii Ashmead

A series of four males from Southwestern Research Station, 5 miles west of Portal, Arizona, 5400 ft. elev., August 27, 1959 (H. E. Evans), provides a significant extension in range.

I have found this species to be reasonably common during the past two seasons at Plummers Island, Maryland, having taken one female and eleven males, September 6 and 13, 1958, and one female and fourteen males, August 29, and September 4 and 12, 1959. Individual wasps fly around rapidly, alighting on foliage on bushes or on leaf litter on the ground. I suspect that females

[1] Krombein, K. V., 1957. A Generic Review of the Amiseginae, a Group of Phasmatid Egg Parasites, and Notes on the Adelphinae. Trans. Amer. Ent. Soc. 82: 147–215, pls. 19–22.

are more abundant than the records of capture indicate. Presumably they spend much of their time crawling around on the ground searching for eggs of the walking stick host.

Mesitiopterus townsendi Ashmead

A second male of this species from Fortin de las Flores, Veracruz, Mexico, 3000 ft. elev., June 10, 1959 (H. E. Evans), differs from the male type from Jicoltepec near San Rafael, Veracruz, in having the head a brighter green and the dorsum of the thorax dark metallic blue. It agrees with the type in having many of the scutellar punctures confluent in transverse rows. This is the only sculptural feature that separates *townsendi* from *kahlii,* so it is possible that additional material from Mexico may establish that *townsendi* is at most a weak subspecies of *kahlii.* A third male from 20 miles west of San Cristobal los Casas, Chiapas, Mexico, 6000 ft. elev., May 3, 1959 (H. E. Evans), has dark blue reflections on the first two abdominal terga as well as the thoracic dorsum.

Mesitiopterus floridensis, new species (Fig. 6)

K. W. Cooper recently captured a series of *Mesitiopterus* at Gainesville, Florida, that represents a discrete new species. The larger size as compared with that of *kahlii* indicates that *floridensis* probably parasitizes eggs of a walking stick larger than *Diapheromera,* the only known host of *kahlii.* Cooper collected these in association with a series of the new species of *Adelphe* that is described below, so it is possible that *floridensis* also parasitizes ova of *Anisomorpha.*

This new species is distinguished from *kahlii* by the larger size (3.5–4.0 mm. long), integument of head and thorax with very dark bronze or blue reflections and no golden reflections, slightly broader and flatter upper face and vertex, and posterior surface of propodeum more delicately punctate. The legs are light red except apices of tarsi in both sexes and a small black blotch near apex of hind femur in the male. In addition, the male genitalia are very distinctive in that the aedeagus is longer than the parameres. These structures are of equal length in the other species of *Mesitiopterus.*

The behavior of *floridensis* in the field is similar to that noted for the new species of *Adelphe* described below.

Type.—♂; Gainesville, Alachua Co., Florida; September 2, 1958 (K. W. Cooper) [U. S. National Museum, Type No. 64873].

MALE.—Length 4.0 mm., forewing including tegula 3.2 mm. Black, shining; dorsum of head and thorax with dark bronzy reflections, mesopleuron with dark blue reflections; legs light red except apices of tarsi and blotch at apex of hind femur infuscated; scape reddish beneath and at apex. Scattered erect vestiture of dorsum of head and thorax black, about 1.3 times as long as diameter of an ocellus.

Upper part of face and vertex flat; head 2.34 times as wide as facial width at anterior ocellus; facial concavity with fine, close, arched carinae; upper part of face with small, round punctures which are subconfluent below but sparser toward ocelli; vertex with similar punctures separated usually by the width of a puncture or more.

Pronotum and scutum with small round punctures separated from each other by the diameter of a puncture or more; scutellum with punctures of same size but somewhat more separated; mesopleuron with shallow pits that are subconfluent anteriorly and more separated posteriorly; posterior surface of propodeum with punctures smaller, and more scattered than in *kahlii*.

Allotype.—♀; same data as type except September 6, 1958 [U.S.N.M.].

FEMALE.—Length 3.9 mm., forewing including tegula 3.0 mm. Similar to male in coloration except bronze reflections more brilliant and scape and hind femur entirely light red.

Head as in male but width 2.39 times the facial width at anterior ocellus; propodeum as in male.

Paratypes.—59 ♂♂, 22 ♀♀; same locality, August 31–October 25, 1958 (K. W. Cooper). Paratypes have been placed in the collections of the U. S. National Museum, Academy of Natural Sciences of Philadelphia, Cornell University, and K. W. Cooper.

The paratypes range in length from 3.5 to 4.0 mm. They are quite constant in details of sculpture and coloration. The head width is 2.25 to 2.40 times as wide as face at anterior ocellus. In a few specimens the declivity of the first tergum and a small anterolateral spot on the second tergum are reddish. In the males the infuscation at apex of hind femur is variable in extent, and occasionally it is present only on inner surface.

Mesitiopterus evansi,[2] new species

This distinctive Mexican species bears a superficial resemblance to *floridensis* because of the similarly shaped head and relatively delicate propodeal punctation, but it is smaller, quite differently colored, has the thoracic dorsum more densely punctate, and a relatively shorter aedeagus. The erect vestiture on dorsum of head and thorax is relatively shorter than in the other species of *Mesitiopterus*.

Type.—♂ ; Huajintlan, Morelos, Mexico, 2800 ft. elev.; April 11, 1959 (H. E. Evans) [U. S. National Museum, Type No. 64913].

Male.—Length 3.0 mm., forewing including tegula 2.6 mm. Head and thorax dark aeneous, relatively dull as compared with *floridensis* because of denser punctation, abdomen black and shining; antennae and legs black except apices of coxae, trochanters, bases of femora narrowly, fore tibia beneath, and fore and mid tarsi suffused with reddish; tibial spurs reddish Scattered erect vestiture on dorsum of head and thorax cinereous to brown, about as long as diameter of an ocellus.

Upper part of face and vertex flat; head 2.29 times as wide as facial width at anterior ocellus; facial concavity with fine, close arched carinae; upper part of face with round subconfluent punctures; vertex with similar, somewhat sparser punctures.

Pronotum and scutum with small, rounded, subconfluent punctures; scutellum with punctures of same size but somewhat sparser, most of them separated from each other by at least half the diameter of a puncture; mesopleuron with shallow, subconfluent pits.

Allotype.—♀ ; four miles east of Cuernavaca, Morelos, Mexico, 6000 ft. elev.; June 23, 1959 (H. E. Evans) [U.S.N.M.].

Female.—Length 2.9 mm., forewing 2.1 mm. Coloration and vestiture as in type, but mid femur also reddish beneath. Punctation as in type. Head width 2.20 times as wide as facial width at anterior ocellus.

Paratypes.—3 ♂♂ ; same data as type. 2 ♂♂ ; same data as allotype but June 16 and 25, 1959. 2 ♂♂ ; three miles north of Taxco, Guererro, Mexico, 5500 ft. elev.; June 1 and 19, 1959 (H. E. Evans). Paratypes have been placed in the collections of the U. S. National Museum, Academy of Natural Sciences of Philadelphia, Cornell University, and H. E. Evans.

[2] I take pleasure in naming this species for its collector, Howard E. Evans of Cornell University, in recognition of his many valuable contributions to the taxonomy and ethology of our North American wasps.

The paratypes are 3.0 to 3.3 mm. long. All are very similar to the type in punctation. The paratypes are colored exactly like the type except one paratype from Taxco has the legs almost entirely black except for tibial spurs.

MICROSEGA, new genus

GENOTYPE: *Microsega bella*, new species. Monotypic and by present designation.

This brachypterous genus contains the first flightless amisegine to be recorded from the New World. The absence of a malar groove, absence of postscutellum, and the nondentate propodeum indicate a derivation from the American Series rather than from the brachypterous members of the Australian Series which have a malar groove, a very enlarged postscutellum, and dentate posterolateral angles of the propodeum.

The female of *Microsega* runs to couplet 10 in my key. It may be separated from the Australasian Series by the characters noted above and from the African Series by the lack of lateral scutal lobes, presence of tegulae and very short wings, and the short erect tooth on the inner margin of the tarsal claw.

Microsega, aside from the modifications correlated with loss of wings, is similar in appearance and sculpture to *Amisega* and *Mesitiopterus*. It has a narrow front as in *Amisega*, but the sculpture of the frontal concavity, very shortly setose eyes, and the relatively longer pronotum are characteristic of *Mesitiopterus*.

Microsega is known from the female sex only. It is impossible to predict the form of the male by analogy from those of other species of Amiseginae having brachypterous or apterous females. The brachypterous females of the Australasian Series have fully winged males, but the single known male of the African Series is apterous, as are all females.

FEMALE.—Head as figured (fig. 5), delicately punctured except frontal concavity closely and finely carinate, the height from apex of clypeus to occiput about 1.13 times the width; greatest head width 1.25 times the greatest prothoracic width; malar space moderately developed, a little more than one-fifth the eye height; eyes with very short, erect scattered setae; frontal concavity with close transverse carinae and a feeble median groove; inner eye margins converging strongly toward vertex, the interocular distance at lower end of eyes about 1.5 times the interocular distance at

anterior ocellus; front quite narrow, its width at anterior ocellus 0.4 times the head width; antennal scape a little shorter than combined lengths of pedicel and first two flagellar segments; flagellum fusiform, the segments flattened beneath, progressively shorter until they are wider than long at the fifth; ocelli small, arranged in a large, almost equilateral triangle, the anterolateral ocellar line 0.75 the postocellar line; vertex rounded into front, very slightly convex.

Thorax (figs. 1, 2) delicately sculptured; pronotal dorsum, scutum, and scutellum with median lengths about 6:2:3; pronotal dorsum finely and closely carinate, anteriorly and laterally with arched carinae, posteriorly in middle with longitudinal carinae, the posterior half of lateral margin weakly ridged; anterior and lateral margins of pronotum with a strong reflexed flange; scutum and scutellum with close longitudinal carinae; postscutellum absent; dorsum of propodeum rounding immediately into the oblique posterior surface, the dorsal and posterior surfaces with close transverse carinae; metapleuron and lateral surface of propodeum fused; tegula normal in size; wing very short, extending to posterolateral angle of scutellum.

Fore femur beneath with some scattered, short, erect hairs; tibiae without erect hairs; tarsi beneath with two rows of short close spines; tarsal claw with small erect tooth on inner margin.

Abdomen delicately sculptured, flattened above; first tergum with sides rounded, the basal declivity slightly convex, not margined above.

MALE.—Unknown.

Microsega bella, new species (Figs. 1, 2, 5)

This unique species is based on the smallest specimen of Amiseginae that I have seen. It is known from a single specimen collected near Brownsville, Texas, in connection with some boll weevil studies. J. M. McGough, who sent in the specimen under his number 39, wrote me as follows: "The Sample No. 39 was reared in a field which had been planted in cotton or sorghum the previous year. The base of a pyramidal cage was buried about 2 inches in the soil, and the bolls were placed within. The latter had been cut across the base so as to remove the stems, bracts, or any other part. Then the cage, which had been lined with heavy muslin, was placed over the wooden base. It is possible that the eggs could have been in the soil or on the wooden base."

Type.—♀; Los Fresnos, Cameron Co., Texas; July 13, 1956 (J. M. McGough, No. 39) [U. S. National Museum, Type No. 64874].

FEMALE.—Length 2.3 mm. Front and temples green with golden reflections, vertex almost black; mandible, scape, pedicel, and legs testaceous; thorax light ferruginous, the scutellum with golden reflections; abdomen with first segment reddish, basal two-thirds of second tergum castaneous, remainder dark brown. Vestiture very sparse, consisting of some short suberect hair on temple, and short appressed hair on mesopleuron and abdominal terga.

Head shining, the proportions as noted in the generic description; front just before anterior ocellus with small, rather close punctures; ocellar area and rest of vertex with small scattered punctures; occiput finely transversely lineate.

Thorax shining, proportions and sculpture of dorsum as noted in generic description; mesopleuron above with a narrow smooth strip, the rest of surface closely and finely punctate on anterior half, longitudinally and closely carinate on posterior half; fused metapleuron and lateral surface of propodeum glabrous anteriorly, longitudinally and closely carinate posteriorly.

Abdomen shining; declivity of first tergum mostly smooth but with some fine radiating lineolations above attachment to thorax; disk of first tergum with fine punctures separated by about the diameter of a puncture; second tergum anteriorly with the fine punctures a little more separated, posteriorly with these punctures quite sparse; third tergum with fine, moderately close punctures except for a narrow median strip and the narrow posterior margin.

MALE.—Unknown.

ATOPOSEGA, new name

Atopogyne Krombein, 1957. Trans. Amer. Ent. Soc. 82: 184. (Preoccupied by Forel, 1911.)

W. L. Brown, Jr. and I. H. H. Yarrow called to my attention the prior usage of *Atopogyne* in the ants.

ADELPHINAE

Adelphe mexicana Mocsáry (Fig. 4)

Adelphe Mexicana Mocsáry, 1890. Termesz. Füzetek 13: 46.—Ashmead, 1902. Canad. Ent. 34: 230.—Bodenstein, 1939. Trans. Amer. Ent. Soc. 65: 124.—Krombein, 1957. Trans. Amer. Ent. Soc. 82: 210.—Krombein, 1958. U. S. Dept. Agr. Monogr. 2, Suppl. 1: 96.

I have had an opportunity to study the unique male type in the de Saussure collection, Muséum d'Histoire Naturelle, Geneva, Switzerland, through the kindness of Dr. Claude Besuchet. It is from Orizaba, Veracruz, Mexico, and is in good condition except that the left forewing, right antenna, and last two segments of

left antenna are missing. I remounted it on a card point because the original pin was badly bent and lacked a sharp point.

It is more closely related to an apparently undescribed species from Costa Rica and Panama than to any of the other species available to me. It differs from that species in having the head and thorax dark metallic blue, the frontal concavity punctate, and shorter flagellar segments.

The following descriptive notes were made from the unique type.

Male.—Length 4.9 mm., forewing including tegula 4.1 mm. Head and thoracic dorsum dark metallic blue, propodeum and side of thorax black, dorsum of abdomen castaneous except declivity of first tergum light red, legs and venter of abdomen light red, antenna brown. Vestiture on head and thoracic dorsum moderately long, dense, erect, light tan, suberect and longer on side of second tergum and across third and fourth terga; longer hairs on head and thorax longer than width of antennal scape. Forewing slightly infumated, more strongly so in marginal cell and in a diffused band adjacent to basal vein.

Head with most of punctures separated by less than the diameter of a puncture; frontal basin almost flat, with subcontiguous punctures and a shallow median groove extending halfway to anterior ocellus; vertex with punctures separated by about half the diameter of a puncture; interocular distance at anterior ocellus half the head width; eye height 1.8 times the malar space; ratio of scape, pedicel, and flagellar segments (last two missing) as 14:3:12:7:6:6:6:6:6:6:6, the first flagellar segment 0.75 times the interocular distance at anterior ocellus; ocelli small, in a low triangle, the lateral ocellar and ocellocular distances equal to the diameter of a posterior ocellus, the postocellar distance three times as great.

Median length of pronotal disk half the width at posterolateral angles, the intervals separating the moderately large, rounded punctures ranging from half to as great as the diameter of a puncture; scutum with punctures smaller and more separated; scutellum with the punctures even more separated; median enclosure of propodeal dorsum parallel-sided, as broad as long, one-third as wide as entire dorsum, transversely rugose and with a smooth median ridge that is wider than in *anisomorphae;* enclosed area adjacent to median area transversely rugose on anterior two-thirds, longitudinally rugose at apex; posterior propodeal surface with a median pentagonal area bounded by ridges, as high as long, with a median ridge and more or less irregularly rugose with some smooth areas; the area adjacent to the median area bisected by an oblique ridge.

Abdomen with minute scattered punctures on second segment, and more concentrated minute ones on third and fourth segments.

Adelphe anisomorphae, new species (Fig. 3)

This species has been reared from eggs of the walking stick *Anisomorpha ferruginea* (Beauv.) from Georgia and Louisiana; it is probable that its host in Florida is *A. buprestoides* (Stoll). The fragmentary, teratological female specimen from Royal Palm Hammock, Fla., referred to in my earlier paper, may possibly be *anisomorphae,* though the sculpture is weaker than usual. However, it would be desirable to see additional material from southern Florida before reaching a decision on the status of the population occurring there.

It differs from *mexicana* in the much shorter vestiture; larger, denser punctures on male abdomen; and denser punctation of head and thoracic dorsum, sculpture of propodeum, and proportions of antennal segments, head, and pronotum.

K. W. Cooper noted the following behavioral characteristics of *anisomorphae* at Gainesville, Fla. Both sexes coursed rapidly over leaf litter on the ground, disappeared briefly beneath the leaves, and then went to new sites in short, skipping flights. Both sexes were active from at least 9:30 a.m. to 6 p.m. They occurred both in dense woods and in the open among leaves in sparse grass under large oaks. They did not require bright sunlight for activity. No mating was observed when individual pairs were confined in vials.

The ratio of females to males collected by Cooper was 3 : 10. The sex ratios for two lots of wasps reared from wild ova of *Anisomorpha ferruginea* from Stone Mt., Ga., by D. J. Pirone were 4 : 1 for a lot of five parasitized eggs, and 7 : 8 for a lot of fifteen parasitized eggs.

Type.— ♂ ; Stone Mt., De Kalb Co., Georgia; August or September 1957 (reared by D. J. Pirone at Ithaca, N. Y., from egg of *Anisomorpha ferruginea* (Beauv.) collected by E. F. Menhinick, May 12, 1957, in decaying pine stump) [U. S. National Museum, Type No. 64875].

Male.—Length 3.6 mm., forewing including tegula 2.8 mm. Black, shining, head and thorax with very weak bronzy reflections; legs, except hind tarsi which are infuscated, and antennal scape light reddish; remainder of antenna dark brown. Vestiture on head and thorax, erect, sparse, rather short, pale; sides of second tergum and apices of third and fourth terga

with similar subappressed hair; longer hair on head and thorax shorter than width of scape. Forewing lightly and rather evenly infumated.

Head with most of punctures subcontiguous; frontal basin almost flat, with subcontiguous punctures and a shallow median groove extending halfway to anterior ocellus; interocular distance at anterior ocellus 0.54 times the head width; eye height 1.6 times the malar space; ratio of scape, pedicel, and flagellar segments as 10:2:10:8:7:7:6:6:6:6:6:6:7, the first flagellar segment 0.71 times the interocular distance at anterior ocellus; ocelli small, in a low triangle, lateral ocellar line twice as long as ocellocular line, the latter equal to the diameter of a posterior ocellus, the postocellar line three times as long as ocellocular line.

Median length of pronotal disk 0.4 times the width at posterolateral angles, the punctures tending to be subcontiguous transversely but many of them separated from each other by half or more the diameter of a puncture; scutum with slightly smaller punctures of equal density; scutellum with punctures somewhat more separated; median enclosure of propodeum with sides converging posteriorly, somewhat longer than basal width which is about one-fourth as wide as entire dorsum, transversely rugose and with a median ridge that is narrower than in *mexicana;* enclosed area adjacent to median area very weakly, transversely rugulose; posterior propodeal surface with lateral ridges of median area evanescent but with an oblique ridge in the same position laterally as in *mexicana;* posterior surface with a narrow median ridge, most of surface irregularly rugulose.

Disk of first tergum with small, rather numerous punctures except narrow strip at apex; second tergum with similarly spaced punctures except for a broader apical strip; third and fourth terga with transverse median strips of smaller denser punctures; second sternum with rather dense, somewhat larger punctures than on second tergum, the third and fourth sterna with smaller punctures.

Allotype.— ♀ ; same data as type [U.S.N.M.].

Female.—Length 3.2 mm., forewing including tegula 2.6 mm. long. Colored as in male except hind tarsi concolorous with rest of legs, pedicel and first flagellar segment light reddish, remainder of flagellum dark brown above, light brown below. Vestiture somewhat sparser than in male. Wings as in male.

Head punctured as in male; front narrower, the interocular distance at anterior ocellus 0.44 times the head width; eye height twice the malar space ratio of scape, pedicel, and flagellar segments as 14:4:8:3:3:4:4:4:4:3:3:3:4, the first flagellar segment subequal to interocular distance at anterior ocellus; ocelli larger, the posterior separated from eye by half the diameter of the posterior ocellus; lateral ocellar line three-fifths the postocellar line.

Thorax sculptured as in male.

Abdominal terga with minute punctures that are very scattered except for the normal concentrations across third and fourth terga; sterna punctured as in male.

Paratypes.—9 ♀♀; Stone Mt., Ga.; August 18 to September 13–15, 1957 (reared by D. J. Pirone from ova of *Anisomorpha ferruginea* collected by E. F. Menhinick, May 12, 1957; labeled respectively A 1, A 2, A 3, A 4, B 6, B 7, B 8, B 10, B 11). 7 ♂♂; same data as foregoing but August 28 to September 10, 1957 (labeled respectively A 5, B 1, B 2, B 3, B 4, B 5, B 9). 2 ♀♀, 3 ♂♂; same locality and collector, emergence dates not specified; reared from ova collected May 12, 1957 and December 28, 1957. 102 ♂♂; reared by D. J. Pirone from *Anisomorpha ferruginea* ova parasitized in laboratory by wasps from Stone Mt., Ga., labeled A 1 (4 ♂♂), A 2 (19 ♂♂), A 3 (20 ♂♂), A 4 (18 ♂♂), B 6 (18 ♂♂), B 7 (10 ♂♂), B 8 (5 ♂♂), B 10 (3 ♂♂), B 11 (5 ♂♂); dates of emergence not specified. 1 ♂; Tifton, Ga. 3 ♀♀, 10 ♂♂; Gainesville, Alachua Co., Fla.; September 1–14, 1958 (K. W. Cooper). 1 ♀; Alexandria, La.; emerged February 18, 1959, in laboratory from ovum of *Anisomorpha ferruginea* collected December 31, 1958 (D. J. Pirone). 1 ♂; same data as preceding, but emerged May 5, 1959.

Paratypes have been placed in the collections of the U. S. National Museum, Academy of Natural Sciences of Philadelphia, Cornell University, American Museum of Natural History, University of Michigan, D. J. Pirone, and K. W. Cooper.

There is some variation in size in the material before me. Males range from 2.9 to 3.7 mm. in length, and females from 3.2 to 3.8 mm. The color variation also is very slight. Some males have dark blue reflections on head and thorax, but this may be due to their having been preserved in alcohol. A few males have the hind tarsi concolorous with rest of legs.

Two of the Stone Mt. females (A 2 and A 4) have weak transverse striae across the middle of frontal concavity. None of the males have the concavity so sculptured, including the thirty-eight males reared from these two virgin females. Two females, one from Gainesville, Fla. and one from Alexandria, La., have the median area of the posterior surface of propodeum and the areas adjacent to the median area of the dorsal surface smooth

and glossy. A few specimens show intergradation between this condition and the normally rugulose sculpture of these parts.

Two of the Stone Mt. males have smaller punctures on abdominal terga than is normal, and one of the Gainesville males has the punctation of thoracic dorsum weaker than is normal. There is also variation in the size of the ocelli, some males having slightly larger ocelli, as in the females.

Biology.—I have abstracted the following brief notes from D. J. Pirone's extensive laboratory records. He reared the initial breeding stock from ova of *Anisomorpha ferruginea* (Beauv.) collected by E. F. Menhinick under bark and in crevices of pine stumps at Stone Mountain near Atlanta, Ga. The first group (A series) of 35 eggs, collected in mid-April 1957, yielded a mature wasp larva dissected from the egg on April 23, 16 *Anisomorpha* nymphs between May 8 and 19, 5 wasps (4 ♀♀, 1 ♂) from August 18 to September 6, and 13 eggs were unfertilized. The second group (B series) of 50 eggs was collected on May 12 along with 7 egg shells; 27 *Anisomorpha* nymphs hatched between May 20 and June 27, 11 wasps (5 ♀♀, 6 ♂♂) emerged from August 28 to September 15, and 12 eggs were unfertilized. Some of the *Anisomorpha* from these eggs matured by August 22–31, at which time new ova were found in the rearing cages. Emergence of the wasp is obviously correlated with maturity of its walking stick host.

After emergence each wasp was placed individually in a glass jar or cage with several *Anisomorpha* ova and a piece of moist cotton containing a bit of sorghum. The female wasps showed almost immediate interest in the eggs. The wasp would examine the egg minutely by appressing the antennal flagella closely against the surface, then gnaw a small hole in the chorion and insert its ovipositor. Occasionally the ovipositor would not penetrate and the wasp would then apply the mouth parts again until penetration could be effected. The oviposition puncture was sealed by coagulation of the fluid within the egg. Occasionally the female wasp would carry around in her mandibles the *Anisomorpha* egg which was fully as large as the wasp itself.

The wasps were given *Anisomorpha* eggs that were 1–3 weeks old. Apparently there was not much embryonic development of

the walking stick during that period. One *Anisomorpha* egg, laid between August 22 and September 1, was with the wasp for two days (September 7–9) and then dissected. The contents of the phasmatid egg were still fluid at that time. The egg also contained a slender white wasp egg 0.65 mm. long and 0.15 mm. wide at the middle with a well-developed larva filling the interior. Presumably the chrysidid larva feeds on the contents of the egg during September and then spins a delicate silken cocoon which lines the inside. Walking stick eggs collected by Pirone at Alexandria, La., December 31, 1958 contained chrysidid prepupae in cocoons when the eggs were dissected on February 10 and 20, 1959. Additional observations are needed to determine whether the wasp larva feeds on the largely liquid contents of the *Anisomorpha* egg, or waits until there is a well-developed embryo on which to feed. The wasp emerges from the walking stick egg by bursting off the operculum.

The female wasps lived from 2–3 weeks in captivity. During this period one wasp might attack and presumably parasitize as many as forty walking stick eggs. However, twenty males constituted the maximum progeny reared from any one female. All progeny were males because the parent females had been segregatd in individual cages as soon as they emerged.

Explanation of Figures

(All illustrations by Arthur D. Cushman)

Fig. 1.—*Microsega bella,* new species. Female type. Thorax, dorsal view. (× 40.)

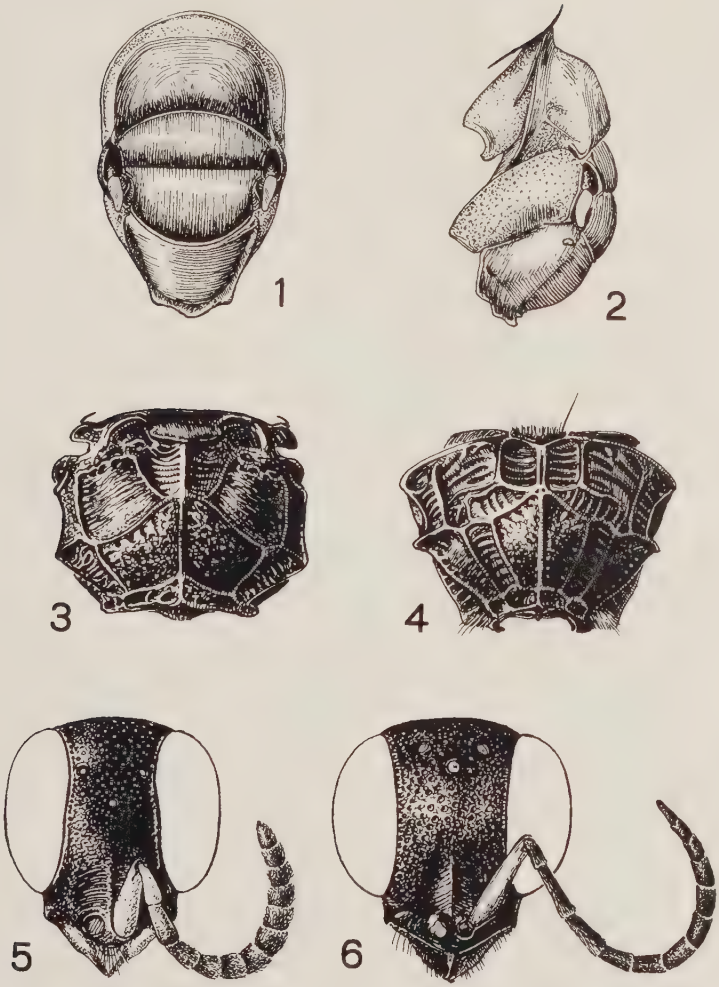
Fig. 2.—*Microsega bella,* new species. Female type. Thorax, lateral view. (× 40.)

Fig. 3.—*Adelphe anisomorphae,* new species. Male paratype (Stone Mt., Ga.). Propodeum from above and behind. (× 40.)

Fig. 4.—*Adelphe mexicana* Mocsáry. Male type. Propodeum from above and behind. (× 30.)

Fig. 5.—*Microsega bella,* new species. Female type. Head, frontal aspect. (× 40.)

Fig. 6.—*Mesitiopterus floridensis,* new species. Male paratype. Head, frontal aspect. (× 30.)



KROMBEIN: ADDITIONS TO AMISEGINAE

THE GENERA OF THE WEEVIL FAMILY ANTHRIBIDAE NORTH OF MEXICO (COLEOPTERA)

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It has become all too apparent that existing North American literature on this interesting family of beetles is either inadequate or incorrect. Many current genera are either incorrectly used or have unsuspected synonymy. It appears that no previous worker has compared North American material with Palearctic or Neotropical forms; as a result, our existing classification is artificial and in many cases erroneous.

It is hoped that this paper will clarify the generic identity of the Anthribidae north of Mexico. It does not answer all questions about relationships, but it does key and define each genus and place all the species of the United States and Canada. In addition, a tribal arrangement is suggested, this being a preliminary step towards a generic revision of the New World fauna.

Although this work has been based primarily on specimens in my own collection, several individuals have been especially helpful in granting loans, making exchanges, or sending material for study. Dr. Mont A. Cazier of the American Museum of Natural History and Mr. Hugh B. Leech of the California Academy of Sciences have both been particularly helpful in all three respects. Also, Drs. Philip J. Darlington, Jr. and William L. Brown of the Museum of Comparative Zoology, Dr. William H. Anderson and Miss Rose Ella Warner of the United States National Museum, Dr. Leland Chandler of Purdue University, Drs. Rupert Wenzel and Henry S. Dybas of the Chicago Natural History Museum, Dr. George Wallace of the Carnegie Museum, Dr. Milton W. Sanderson of the Illinois Natural History Survey, and Dr. Henry Dietrich of Cornell University all have given me access to types

and material in their care. Among private collectors, Dr. David G. Kissinger, Dr. N. M. Downie, and Mr. Dennis Paulson have gone out of their way to obtain material for me, while Dr. Elbert L. Sleeper has loaned some extremely valuable specimens.

Family Description

The basic features of the weevil family Anthribidae follow. Those items marked with an asterisk are among the most diagnostic. No attempt has been made to discover all the exceptions to these features, but some exceptions have been included.

Labrum.—*Clearly visible, separated from the face by a deep suture or groove, and never appearing to fuse with the rostral apex.

Palpi.—*Clearly visible and freely movable, the apices pointed (described as truncate in *Scirtetinus* Jordan from the Seychelles). Maxillary pair 4 segmented, the basal segment small. Labial pair 3 segmented, the middle segment short.

Labium.—Base of ligula covered by heavily sclerotized postmentum (fused submentum and mentum), the latter with or without a longitudinal carina. Apex of ligula exposed, more weakly sclerotized, notched to deeply cleft apically (entire in *Nessiaropsis* Jordan from Africa and *Rhinotropis* Fairmaire and *Dinosaphis* Jordan from Fiji).

Eyes.—On surface of head or on stalks, never on the rostrum; round, oval, truncate, or emarginate; facets coarse to fine, occasionally decreasing in size anteriorly.

Head.—Usually exserted, but retractile into prothorax in several choragine genera. If rostrum present, never long, slender, and cylindrical. Gular sutures invisible (this should be checked more extensively). Sculpture finest on vertex, progressively coarser on frons and rostral area.

Prothorax.—Pleural sutures or their vestiges present (from coxae up towards the dorsal surface). A transverse carina near the pronotal base, appearing basal when the true base is deflexed (absent in *Mesidiotropis* Jordan from Mauritius, *Homeodera* Wollaston from St. Helena, *Gnoticarina* Jordan and *Apinotropis* Jordan of Africa, and some species of *Phaenotheriopsis* Wolfrum from the West Indies). *Pubescence if present directed toward the head. Lateral and subbasal carinae present or absent, variable.

Mesothorax.—Mesepisternum not reaching the coxal cavity. Mesepimeron not reaching the coxal cavity. Scutellum visible, small (covered by elytral bases in those apterous species which have connate elytra).

Metathorax.—Antecoxal strip and groove present before the hind coxae. Median longitudinal groove present or at least indicated. Metasternum produced anteriorly into a small lobe which contacts the mesosternum on the outer side of each middle coxae. Metepisternum elongate, broadest in

apterous forms, widened anteriorly and there diagonally truncated by mesepimeron, partially covered by the elytral margin. Metepimeron small, all but the posterior tip covered by elytra when in repose.

Abdomen.—Tergites 1–7 present, 1–6 partially sclerotized and completely covered by elytra. *Tergite 7 (the pygidium) in large part exposed, truncating the abdominal apex; its base and often the margin raised slightly above a discal sculptured portion, the base with a median longitudinal groove for the reception of a corresponding ridge on the underside of the elytral apices. Tergite 8 internal, partially sclerotized. Sternite 1 membranous and obscure. Sternite 2 and the base of 3 covered by the hind coxae. *Sternites 3 to 7 visible, the sutures still clearly evident but immoveable (these are sternites 1–5 of taxonomic literature). Lateral margins of sternites 2–7 reflexed and covered by lower margin of elytra when in repose. Sternite 8 internal, membranous (unless the "spiculum gastrale" is considered part of it).

Genitalia (tentative until a more complete survey is made).—Well sclerotized in both sexes. Male aedeagus bird-beaked (with a large moveable dorsal plate) and with two long apodemes, the latter with a cross-piece near their bases. Gonocoxite (tegmen, paramere) complete, with ventro-anterior strut and dorso-posterior cap-piece, rarely the latter reduced to a flattened, emarginate process. Females with a sclerotized ovipositor, the valvifers with strong apodemes, the coxites usually toothed or scoop-shaped apically, the styli lateral, not apical, and set in a concave area.

Elytra.—Not covering all of pygidium, the apices rounded. *Scutellar stria present both externally and internally (can be reduced to a single puncture or absent in those apterous species where the elytra are permanently fused and in *Prototropis* Jordan from Mauritius. With ten rows of punctures, in addition to the abbreviated scutellar one (fourteen in *Alloschema* Jordan from Africa, 18 or more in *Acaromimus* Jordan from Central America and SE. United States). Sutural edge at apex with internal ridges which fit into basal groove of pygidium. Marginal edge with a short oblique carina on ventral side near the base (this should be checked more extensively). Epipleural fold present, becoming narrow or obscure apically. Surface sculpture extremely varied, usually best developed (if present) on third and fifth internals.

Tarsi.—5 segmented, but appearing to have only 4. Segment 2 emarginate at apex and partially embracing 3, not spongy-pubescent beneath. *Segment 3 set into the apex of 2 and bilobed (the two lobes fused down the midline in *Anthribus* Forster of Europe and *Phoenicobiella* Cockerell of southeastern United States and the Antilles), spongy-pubescent beneath. Segment 4 almost invisible, arising vertically from the upper surface of 3 and inserting on the lower surface of 5. Segment 5 completely covering 4 in dorsal view, provided with two separate claws, each toothed, cleft, or with a basal protuberance (rarely unarmed as in *Meganthribus* Jordan from the Oriental region, and *Ormiscus simplex* (Pierce) and *Allandrus populi* Pierce from the United States).

Legs.—Femora without teeth (a long hooked process on the hind femora of some male *Plesiobasis* Jordan from Fiji). Tibiae without moveable spurs at apex, although non-moveable hooks or spines are often found as male secondary sex characteristics (and on the hind tibiae of both male and female *Xenopternis* Jordan from Java).

Coxae.—Front coxae globular, always separate (?), grooved on inner surface for reception of the intercoxal process of the prosternum; the cavities closed behind. Middle coxae globular, separate; the cavities surrounded by meso- and metasterna only. Hind coxae transverse (except *Cisanthribus* Zimmerman from the South Pacific and perhaps a few other hunched, convex, mite-like genera, in which these coxae are globular) separate, limited laterally by the metepisternum.

Antennae.—11 segmented (10 in *Gnoticarina* Jordan and most *Decataphanes* Labram and Imhoff from Africa). *Nongeniculate; capitate in all species with short antennae, the club usually obscure in species with elongate antennae especially when longer than body. The number of apical segments involved in the club is usually three. However this varies from a two-segmented club in *Corynaecia* Jordan from the Seychelles, *Megatermis* Jordan from Mauritius, and *Enspondus* Blackburn from Australia, to an eight-segmented club as in *Heniocera* Jordan from Mauritius and *Callanthribus* Jordan from New Guinea. Several genera have four or five-segmented clubs, the number sometimes sexually dimorphic; one Japanese species, *Tropideres flabellicornis* Sharp, has a seven-segmented club in males and three-segmented in females. No species are known with a six-segmented club.

Male secondary sexual characteristics.—Rostrum: longer, wider apically, narrower at base, or more strongly carinate. Postmentum: apical lobes tuberculate or with more acute tips. Eyes: closer together on frons or slightly more oblique. Antennae: longer, less well defined club, erect pubescence on ventral surface of club and proceeding segments, more club segments, or fourth segment enlarged. Prothorax: narrower or more coarsely sculptured. Elytra: narrower, less inflated or more tapering and declivous apically. Metasternum: with paired rounded pits densely filled with short, erect pubescence or with a median circular glabrous area. Coxae: with a small tooth, tubercle, or rounded pit filled with dense erect pubescence. Femora: slightly longer, more swollen, minutely tuberculate, with an erect fringe of hairs, a hooked anteapical process, or a small antemedian spine. Tibiae: with an apical spur, hook, raised ridge, flattened plate or row of long bristles; more elongate (especially anterior pair), or apically curved or bent. (None of these involve all legs simultaneously.) Tarsi: segments elongated or with erect ventral pubescence, one or more claws apically cleft instead of toothed, or a ventral spine on the basal segment. Abdominal sternites: concave in lateral view; with a median brush of erect pubescence; one or more with a median pubescence-filled pit, tubercle or hair tuft, or with paired tufts or tubercles, or fifth sternite

shorter. Pygidium: appearing more "tucked in"; apex differently shaped; or with discal tubercle more dorsal in position.

Female secondary sexual characteristics.—Opposite or absence of the above male features. Fifth sternite with an anteapical transverse ridge.

Higher Categories

Before discussing the North American genera, there are several items pertaining to subfamily and family levels of classification which require comment. First is the family name of the insects in question. They have been known variously as Anthribidae, Platystomidae, Choragidae, Platyrrhinidae, and Anthotribidae. Most of the confusion was due to the misconception that the name *Anthribus* was not applicable within the Rhynchophora. Pierce (1916, 1930) and then Jordan (1931) have gone into the matter in some detail. Dr. Jordan has, I think, shown conclusive evidence for retaining *Anthribus* in the Rhynchophora and therefore maintaining its availability for the type genus of the weevil family long known as Anthribidae. In brief, Jordan showed that *Anthribus* can be credited either to Geoffroy 1762, with *latirostris* Fabricius (= species no. 3 of Geoffroy) as type species, or else to Forster 1771, with *fasciatus* Forster as type species. Since The International Commission on Zoological Nomenclature has recently decided that Geoffroy's work is not available nomenclatorially, *Anthribus* dates from Forster 1771; and (as has been recognized in Europe for several years) takes precedence over *Brachytarsus* as used by older European writers. For a more complete discussion, see the above papers and also Bradley (1930, 1946).

A second feature requiring comment is the choice of names for subfamilies within the Anthribidae. Bradley (1930) and Pierce (1916, 1930) both pointed out that the familiar names "Pleurocerinae" and "Anocerinae" of anthribid literature (dating from Lacordaire, 1866) are invalid as they are purely descriptive and not formed from the stem of generic names within the family. Accordingly, they can be replaced by Anthribinae and Choraginae respectively. These two subfamilies were raised to family status by Pierce (1916). Later (1930) he attempted to explain this action by stating that at least some of the "Choragidae"

have four-segmented labial palpi, including the genera *Choragus, Holostilpna,* and *Araecerus;* he illustrates this condition in *Araecerus* (pl. 4, fig. 68). This feature was contrasted with the remaining anthribids which have three-segmented labial palpi. There is of course a remote possibility that Pierce did have a specimen of *Araecerus* with four-segmented palpi, but to include the other two genera also was grossly incorrect. The labial palpi of the Choraginae (-idae of Pierce) are three-segmented as in all other anthribids. The extra basal segment drawn by Pierce simply does not exist. In addition to the labial palpi, the only other feature used by Pierce for separating the Choragids from the remainder of the family was the location of the antennal insertions " on the upper surface of the rostrum near the eyes " in Choragidae, and " on the sides of the rostrum " in the others (p. 1). This distinction is useful but the character is not sharply discontinuous, as can be seen from a study of the genus *Discotenes* Labram and Imhoff. Pierce's own illustration (pl. 1, fig. 1) of *D. nigrotuberculata* (Schaeffer) from Texas, will show how difficult it is to draw the line between his two alternatives, and the Mexican *D. lutosus* Jordan has the scrobes (which are basically lateral in most species in the genus) even more dorsal and more Choraginae-like. It does not seem sound to erect a family on erroneous observation plus a single continuously intergrading characteristic. Therefore, I disregard Pierce's changes without further comment except to say that use of the genus *Choragus* to form the name of a higher category does not date from Des Gozis 1882, as stated by Pierce, but from Kirby 1818 who described *Choragus* as the sole member of a new family, Choragidae.

Excluded Genera

Various authors have tried to include in the Anthribidae such genera as *Rhinomacer* as used by Leconte 1876, *Bruchela* Dejean 1821 (equals *Urodon*), and *Cercomorphus* Perris 1864. None of these are anthribids. The genus *Rhinomacer* (I have studied *R. elongatus* Leconte, *pilosus* Leconte, *bombifrons* Leconte, and *comptus* Leconte) differs because it possesses contiguous, conical front coxae; elytra without a scutellar stria; abdomen with all visible sutures flexible; pygidium with at most the tip exposed;

labrum forming a continuous surface with rostrum; tibiae with 2 small moveable apical spurs; tarsi with the first and third segments spongy-pubescent beneath; female genitalia poorly sclerotized and without ridges or teeth on the coxites, and with apical styli. *Bruchela* (based on *B. suturalis* (Fabricius) and *rufipes* (Olivier)) is not an anthribid genus because its elytra lack an external scutellar stria and are rounded-truncate at apex; the abdomen has all visible sutures flexible; the pygidium is not margined basally; the labrum forms a continuous surface with rostrum; the prothorax has pubescence pointing posteriorly and the basal margin produced backwards over the scutellum; the third tarsal segment is not immersed in the second; the first and second tarsal segments are pubescent beneath; and the male median lobe is without a cross bar connecting the struts. *Cercomorphus* (based on one specimen tentatively determined as *C. bicolor* Abeille) differs because its elytra lack a scutellar stria and are shortened as in *Bruchela;* the pygidium is not margined basally; the tibiae have several small apical spurs; the tarsi have simple claws and the third segment is free from the second and not in the least bilobed (not phytophagous). The problem of what to do with these three genera and their close relatives has been touched upon by many coleopterists. Some of the more recent points of view are presented by Anderson (1943, 1947), Bridwell (1932), Crowson (1954), Jordan (1925), Pierce (1930), and van Emden (1938). *Rhinomacer,* along with *Didorhynchus, Nemonyx, Rhynchitomacer,* and *Rhinorrhynchus* (I have not seen the last two), forms a separate and distinctive family Nemonychidae, distinguished from all other rhynchophora by their functional labrum, labium and palpi, their straight antennae, double gular sutures, and bispined tibial apices. *Bruchela* has been the subject of considerable controversy, some workers calling it an anthribid, and others calling it a bruchid. Both sides have gone to considerable trouble to document their own points of view. I think the single gular suture of the adult, plus the hypopharyngeal bracon of the larva indicate unmistakable curculionoid relationships, while the remarkably bruchid-like appearance is due to convergence, both groups spending their larval and pupal life within various plant seeds. Once within the rhynchophora

Bruchela requires family status, distinguishable by the functional labrum, labium, and palpi, the straight antennae, and the mass of features mentioned above. *Cercomorphus* is more of a problem for the single tiny specimen examined (Tourah, Egypt, III-28-09, ex coll. Alfieri) has not been dissected, and as a result I am uncertain as to the structure of the mouthparts, abdomen and genitalia. Even the tarsal formula is uncertain, as I can count only four segments and have no idea whether a segment has been overlooked or not. The straight, capitate antennae, non-bilobed third tarsal segment, shortened elytra, and huge exposed, bruchid-like pygidium give a most unusual appearance. Its final status must await study of additional material.

Key to the Subfamilies, Tribes, and Genera of Anthribidae North of Mexico

1. Antennae inserted on the anterior surface of the rostrum or head; antennal club never four segmented ..... Choraginae 2
   Antennae inserted on the lateral or ventral surface of the rostrum; if in doubt, antennal club four segmented ..... Anthribinae 6
2. Eyes rounded, the upper edges not closer together than the lower (Araecerini) 3
   Eyes elongate-oval, the upper ends closer to each other than the lower (Choragini) 4
3. Elytra with 10 rows of punctures in addition to the scutellar one *Araecerus* Sch.
   Elytra with 19–21 confused rows of very fine punctures *Acaromimus* Jord.
4. Head not retractile into prothorax, the eyes too wide; pronotum with a raised reticulate pattern ..... *Choragus* Kirby
   Head capable of being retracted into prothorax; pronotum punctate but not raised-reticulate 5
5. Elytra with 10 single rows or groups of punctures ..... *Euxenus* Lec.
   Elytra with 12 rows of punctures, the 11th present on basal half only *Euxenulus* n. gen.
6. Each elytron partially enclosing the anterior part of the scutellum, the resulting scutellar notch shaped like an inverted omega (Gymnognathini) ..... *Gymnognathus* Sch.
   Scutellar notch forming a simple V, U, or ⊔ 7
7. Rostrum with a dorsal, median carina, interrupted at base by an abrupt, small, very deep pit or groove (Platystomini) 8
   Rostrum carinate or not, with at most a basal puncture 9
8. Lobes of all third tarsal segments separate ..... *Toxonotus* Lacord.
   Lobes of all third tarsal segments fused ..... *Phoenicobiella* Cocker.

9. Mandibles with a strongly toothed ventral cutting edge, as well as the normal dorsal edge (Eupariini) ..... *Euparius* Sch.
   Mandibles without a toothed ventral cutting edge 10
10. Eye entire, or truncate or faintly sinuate on anterior face 11
   Eye strongly notched or emarginate on anterior face (nearest insertions of antennae) 19
11. Rostrum thick, the width at apex less than twice the depth (Discotenini) 12
   Rostrum compressed apically, the width at apex more than twice the depth 13
12. Antennae inserted near the eyes, the club 4 segmented *Discotenes* Lab. and Imh.
   Antennae inserted nearer base of mandibles than eyes, club 3 segmented ..... *Ischnocerus* Sch.
13. Eyes coarsely faceted, less than 25 longitudinal rows of ommatidia, if in doubt, transverse carina of prothorax arched forward in the center (Piesocorynini) 14
   Eyes finely faceted, more than 26 longitudinal rows of facets 15
14. Antennal segment 3 longer than either 2 or 4 .... *Piesocorynus* Dejean
   Antennal segment 3 equal to 2 or 4, or else 2 longest .. *Brevibarra* Jord.
15. When viewed head on, the eyes not or only slightly protruding laterally; face densely white pubescent (Tropiderini) ... *Tropideres* Sch.
   When viewed head on, the eyes noticeably protuberant laterally, the face not white 16
16. Rostrum elongate, greatly flattened and widened at apex (Allandrini) 17
   Rostrum short, at most slightly widened at apex (Platyrhinini) 18
17. Antennal segments with whorls of slender erect hairs; transverse pronotal carina almost basal ..... *Stenocerus* Sch.
   Antennal segments without erect whorls; transverse pronotal carina strongly antebasal ..... *Allandrus* Lec.
18. Pronotum with a large median depression, lateral carina ending in a sharp tubercle ..... *Trachytropis* Jord.
   Pronotum with paired para-median depressions or none, lateral carina ending in a low ridge or faintly projecting ..... *Goniocloeus* Jord.
19. Rostrum quadrate, or with rounded apical angles 20
   Rostrum, ignoring the mandibles, narrowed from base to apex; rostral apex with central ⅓ longer than sides (Anthribini) *Trigonorhinus* Wollast.
20. Intercoxal process of mesosternum laterally angulate, or else antennae very short. The greatly swollen club almost as long as segments 1–8 (Eugonini) 21
   Intercoxal process of mesosternum without a lateral angulation, antennae never with the club almost as long as the remainder (Ormiscini) 22

21. Lateral prothoracic carina extending to apex where it is toothed; antennal scrobes strongly produced towards ventral midline *Eugonus* Sch.
    Lateral prothoracic carina not approaching apex, nor apically toothed, antennal scrobes widely separated on venter ..... *Phaenithon* Sch.
22. Lateral prothoracic carina absent or if present not reaching anterior margin ..... *Ormiscus* Waterh.
    Lateral prothoracic carina extending to apex ..... *Araeoderes* Schaeff.

Generic Discussion

ARAECERUS

Araecerus Schoenherr 1823. Isis von Oken, heft 10, p. 1135. Type: *Anthribus coffeae* Fabricius 1801, by original designation and monotypy, equals *Curculio fasciculatus* DeGeer 1775.

Araeocerus Schoenherr 1839. Gen. et Sp. Curculionidum 5(1): 273. Emendation.

Araeosarus Walker 1859. Ann. and Mag. Nat. Hist. [3] 3: 262. Emendation.

North American species.—fasciculatus (DeGeer) 1775.

Species examined.—fasciculatus (DeGeer) 1775, *vieillardi* (Montrouzier) 1860.

Within the Choraginae, the round eyes of this genus are shared with *Acaromimus* Jordan. The latter however has 19–21 elytral striae as opposed to the normal 10. Other features of *Araecerus* are: head non-retractile, rostrum apically truncate, preapical mandibular tooth present, scrobes non-tuberculate, pronotum reticulate, and lateral carina single.

Our single species, the Coffee Bean Weevil, has been spread by commerce over the world. The genus is an extensive one, the species centering in the Oriental and Australian regions.

ACAROMIMUS

Acaromimus Jordan 1907. Biologia Centrali-Americana 4(6): 381. Type: *Acaromimus sharpi* Jordan 1907, by original designation and monotypy.

Acaropsis Jordan 1907. Biologia Centrali-Americana 4(6): 382, and pl. 14, fig. 31. Lapsus calami.

Xenorchestes Motschoulsky 1873. Bull. Soc. des Nat. Moscou 46(1): 261. In part, *nec* Wollaston 1854.

Euxenus Blatchley 1920. Jour. N. Y. Ent. Soc. 28(2): 162. In part, *nec* Leconte 1876.

North American species.—*americanus* (Motschoulsky) 1873.

Species examined.—*americanus* (Motschoulsky) 1873, *sharpi* Jordan 1907.

This is the most aberrant genus in the North American fauna. Instead of the normal 10 striate elytra of the family it has from 19 to 21 rows of very fine punctures on each elytron. In addition the body is very strongly humped, convex, and mite-like, the lateral prothoracic carina is upturned at its tip, the eyes are round and have very large facets. The head is retractile, the pronotum is punctate, not reticulate, the scutellum is absent, the elytra are fused, the body is apterous, and the meso- and metacoxae are so bunched together that they are barely separated from one another by the attenuate metasternal side pieces.

The species discussed by Blatchley (1920: 162; 1922: 98; 1928: 238) as *Euxenus piceus* Leconte is actually *A. americanus* (Mots.). I have seen specimens collected by Blatchley and determined by him as *E. piceus* from all of the lots discussed in the three above papers, except the Cape Sable record (1920: 162). *A. americanus* is now recorded from Florida, Alabama, and Texas.

CHORAGUS

Choragus Kirby 1818. Trans. Linn. Soc. London 12: 447. Type: *Choragus sheppardi* Kirby 1818, by monotypy.

Alticopus Villa 1833. Col. Eur. Dupl. Suppl. p. 35. Type: *Alticopus galeazzii* Villa 1833, by monotypy, equals *Choragus sheppardi* Kirby 1818.

Holostilpna Jordan 1907. Biologia Centrali-Americana 4(6): 382. Type: *Choragus nitens* Leconte 1884, by original designation. **NEW SYNONYMY.**

North American species.—*harrisi* Leconte 1878, *nitens* Leconte 1884, *sayi* Leconte 1876, *zimmermanni* Leconte 1876.

Species examined.—All of the above and *sheppardi* Kirby 1818, *horni* Wolfrum 1930.

Eyes elongate-oval and converging above, head not retractile, pronotum reticulate, lateral prothoracic carina short and single. The above features will distinguish *Choragus* from our other Choragines. Other characteristics are the tuberculate scrobes, the slightly antebasal transverse prothoracic carina, and the absence of a preapical mandibular tooth.

In 1907, Jordan designated *Choragus nitens* Lec. as type of a

new genus, *Holostilpna*. Unfortunately, Jordan's specimens of *nitens* were misdetermined; instead he had an undescribed species of *Euxenus* Leconte. Since the species *nitens* Leconte is a perfectly typical *Choragus*, *Holostilpna* with *nitens* Leconte as type becomes a synonym of *Choragus*.

A key to the species of *Choragus* will not be presented here for the genus needs a careful revisionary study. There are several undescribed species in eastern United States which complicate the picture, while the descriptions of existing species are hopelessly inadequate.

EUXENUS

Euxenus Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 409. Type: *Euxenus punctatus* Leconte 1876, by monotypy.

North American species.—*ater* Blatchley 1928, and *punctatus* Leconte 1876.

Species examined.—The above.

Within our fauna, *Euxenus* is distinctive in having a double carina on the sides of the prothorax. The lower of these carinae is often less developed, and is at times partially obscured by a row of punctures. If in doubt, the following combination of features is diagnostic. Eyes elongate-oval and converging above, antennae inserted at their inner lower corners, the scrobes tuberculate; head retractile, rostral apex sinuate, preapical mandibular tooth absent; scutellum present; elytra 10 striate with an additional scutellar stria, however the striae are, in some species, replaced by multiple or confused rows of punctures; pronotum with transverse carina slightly antebasal, the disc punctate not reticulate, body almost glabrous, shining.

The genus *Holostilpna* was based on two specimens of an undescribed species of *Euxenus* which had been erroneously determined as *Choragus nitens*. Dr. Jordan told me (*in litt.* June 30, 1954) that these specimens are from Bladensburg, Maryland, and were purchased many years ago from the now defunct American Entomological Company. He further states that the male individual is the type of his description.

In 1942, Dr. W. H. Anderson of the United States National Museum discovered some unusual anthribid larvae in fungus on

black oak at University Park, Maryland. Adults were reared and subsequently determined by L. L. Buchanan of the same institution as *Holostilpna nitens* (Leconte). These larvae were sufficiently unusual that Dr. Anderson published (1943) a paper on their structure and relationships. A few years later he very generously gave me a series of his reared adults. As in Dr. Jordan's case, they too represent an undescribed species of *Euxenus*. Unfortunately, I have not yet seen Jordan's specimens, and so cannot state whether these two populations, both from Maryland, represent one or two species.

As in the genus *Choragus*, I am unwilling to present a key to our species of *Euxenus* until a careful study is possible. There are undescribed species in eastern United States in addition to those from Maryland discussed above.

EUXENULUS new genus

Euxenulus new genus. Type: *Euxenus piceus* Leconte 1878. Proc. Amer. Philos. Soc. 17(101): 434.

North American species.—*piceus* (Leconte) 1878.

Species examined.—The above.

Closest to *Euxenus* Leconte 1876, but differing in the possession of 12 rows of elytral punctures, a preapical mandibular tooth, and the absence of a scutellum.

A genus of minute, oval, mite-like Anthribidae with the antennae inserted between the lower ends of the broadly oval eyes, the head retractile into the prothorax, rostral apex sinuate, mandibles with a small preapical tooth, the scrobes with a tubercle on their inner margins, the pronotum punctate not reticulate, the transverse pronotal carina slightly antebasal, the lateral carina not reaching apex and with indications of a second carina beneath it, no visible scutellum, elytra each with 12 rows of punctures, the 11th present on basal half only, body almost glabrous the pubescence very obscure.

The above description will distinguish *Euxenulus* from all other genera in the family. It is possible that better prepared material will reveal the presence of a minute scutellum, for the species appears to have separate elytra. Ordinarily the scutellum is absent only in apterous forms with connate elytra. Another feature of

Euxenulus is the indistinctness of the scutellar stria. I have been unable to determine whether the stria is absent, or if the punctures are present but confused with those of the sutural stria, and thus overlooked. There are one or two punctures slightly out of line on either side of the scutellum, but their identity is uncertain. The single species is known only from Florida.

DISCOTENES

Discotenes Labram and Imhoff 1838 or 1842. Sing. Gen. Curc. 1, no. 49. Type: *Discotenes coelebs* Labram and Imhoff 1838 or 1842, by monotypy.

Phanosolena Schaeffer 1904. Jour. N. Y. Ent. Soc. 12: 234. Type: *Phanosolena nigrotuberculata* Schaeffer 1904, by original designation and monotypy. Synonymy by Jordan 1906, Biologia Centrali-Americana 4(6): 308.

North American species.—*nigrotuberculata* (Schaeffer) 1904 and *arizonica* (Schaeffer) 1906.

Species examined.—The above two and *lutosus* Jordan 1906, *cylindratus* Jordan 1906, and a new species from Central America.

This is the only genus in our fauna with a four-segmented antennal club. Other characteristics are: the eyes are entire and lateral; the transverse carina of the prothorax is antebasal; the rostrum is widest at the apex; the intercoxal process of the mesosternum is narrow, triangular, has the apex rounded; the antennae are inserted on the edge of the beak, the insertion partially visible from above.

Discotenes and *Ischnocerus* appear to form a natural unit in our fauna, despite the fact that Pierce (1930) placed them in separate tribes. His separation, based on the length of the beak, is strictly artificial, since the beak length varies from species to species in both genera, and in addition is strongly dimorphic sexually. In the absence of antennal clubs, the only feature in the species seen which is constant in separating the two genera is the presence, in *Discotenes,* of a transverse groove separating the postmentum (Ting, 1936) from the gular region. This groove was not present in the three species of *Ischnocerus* studied.

Our species are distinguished by the following features:

1. Interocular area with very large shallow punctures which have a faint tendency to form longitudinal rows; transverse pronotal carina entire; space from eye to scrobe very narrow, much less than the diameter of a front tibia; Texas .... *D. nigrotuberculata* (Schaeffer)

   Interocular area with strong vertical rugae separated by rows of shallow punctures; transverse pronotal carina with a narrow median interruption; space from eye to scrobe about equal to the diameter of a front tibia; Arizona ..... *D. arizonica* (Schaeffer)

ISCHNOCERUS

Ischnocerus Schoenherr 1839. Gen. et Sp. Curc: 5(1): 191. Type: *Ischnocerus infuscatus* Fahraeus 1839, by original designation.

Meconemus Labram and Imhoff 1838 or 1842. Sing. Gen. Curc. 1, No. 40. Type: *Meconemus tuberculatus* Labram and Imhoff 1838 or 1842, by monotypy, equals *Ischnocerus infuscatus* Fahraeus.

North American species.—*infuscatus* Fahraeus 1839, *angulata* Martin 1930.

Species examined.—The above and *aeneus* Jordan 1895.

In *Ischnocerus,* the antennal insertions are on the edge of the beak, visible from above, and the antennal club is three segmented. Also, there is no transverse groove in the gular region. In other respects, this genus is similar to *Discotenes.* Our two species have an unusual character in the presence of a lateral tooth-like angulation on the anterior margin of the prothorax. The Neotropical species examined does not show this feature.

Contrary to the statement of Pierce (1930, p. 20), *Ischnocerus* Sch. is not preoccupied by *Ischnoceros* Gravenhorst 1829 in the parasitic Hymenoptera.

Recently, Wolfrum (1953) resurrected *Meconemus* of Labram and Imhoff, since the date of their *Singulorum Generum Curculionidum* is supposedly 1838, a year earlier than *Ischnocerus* of Schoenherr. Internal evidence from the two works in which these names appeared indicates that the Schoenherr name is older. *Ischnocerus* appears first in volume five, part one, of Schoenherr's *Genera et Species Curculionidum,* dated 1839. This book contains no mention of the Labram and Imhoff work. On the other hand, Labram and Imhoff cite Schoenherr vol. 5, part 1 in the synonymy of *Xylinades,* the genus which preceeds *Meconemus.*

This implies that *Ischnocerus* was already published when Labram and Imhoff were writing their descriptions. Ordinarily this would settle the matter, but the *Singulorum Generum Curculionidum* did not appear all at once; it was issued in sections (Heft 1 to 22). Heft 1 to 10 are often cited as 1842, following the date printed on their blue paper covers. Some of these may have appeared earlier than others, and not necessarily in the sequence used when they were bound. Since I cannot now reconcile these conflicting possibilities, I am retaining *Ischnocerus* on the double basis of apparent priority and long established usage.

Our two species can be separated as follows:

1. Pronotum much paler than disc of elytra; transverse carina with a large posteriorally projecting median loop; pygidium almost solid creamy white; Arizona ..... *I. angulata* Martin
   Pronotum and disc of elytra similarly colored; transverse carina with at most a weak median curve or angulation; pygidium mottled gray and brown; Maryland to Texas in the Coastal Plain, and throughout Central America to Venezuela ..... *I. infuscatus* Fahraeus

EUPARIUS

Euparius Schoenherr 1823. Isis von Oken, Heft 10, p. 1135. Type: *Anthribus lunatus* Fabricius 1801, by monotypy, equals *Macrocephalus marmoreus* Olivier 1795.

Cratoparis Dejean 1833. Cat. Col., ed. 3, p. 235. Nomen novum non necess.

Caccorhinus Sharp 1891. Trans. Ent. Soc. London 1891, p. 321. Type: *Caccorhinus oculatus* Sharp 1891, by monotypy. **NEW SYNONYMY.**

North American species.—*marmoreus* (Olivier) 1795, *paganus* Gyllenhal 1833, *subtesselatus* Schaeffer 1906, *lugubris* (Olivier) 1795, and an undescribed species.

Species examined.—The above and *oculatus* (Sharp) 1891, *torquatus* (Jekel) 1855, *dorsalis* Boheman 1833, *polius* Jordan 1904.

American anthribid genera usually have an anteapical tooth on the dorsal edge of the mandible; *Euparius*, however, has an additional tooth on the ventral edge which is usually larger and nearer the base than the dorsal one. If this definitive character is difficult to observe, the genus may be recognized by the following combination of features. The transverse carina of the prothorax is basal, the eye is truncate or slightly convex on the side adjacent to the antennal grooves, and the apex of the rostrum is broadly and sinuately emarginate. The lateral carina of the pro-

thorax is well developed and joins the dorsal one at an abrupt angle, usually of about 90 degrees or a little less. Other characters as the shape of the rostrum and the mesosternal process vary too much to be diagnostic to genus, although they are very useful on the species level.

Schoenherr first used *Euparius* in 1823, where in a "Tabula synoptica Familiae Curculionidum" it is listed under ordo 1, section 1, division 2, subdivision 1, cohors 2 as follows: "9. EUPARIUS nob. Typ.: EUPAR. TIGRIS nob.—(congenericus: ANTHRIB. LUNATUS Fabr.)". However, *E. tigris* is a manuscript name that was not validated until 1833. Therefore, *Euparius* has only one validly described species, which automatically becomes the type.

Cratoparis was proposed by Dejean, apparently as a substitute name, in the mistaken belief that *Euparius* Sch. was preoccupied by *Euparia* Serville 1825.

Caccorhinus is the name used for the Old World members of the genus. The genotype, *oculatus* Sharp, is from Japan, while other species extend the range south to Australia and west to India. Fortunately, both sexes of *C. oculatus* were received in an exchange with Mr. Yoshiaki Nishio of Japan. These specimens are so close to our *Euparius subtesselatus* Schaef. that there is no question of their being congeneric. The only structural difference is the slightly more convex eye of the Japanese species, while the color and pattern are similar enough to suggest a subspecific relationship. In the absence of any discontinuity of characters between the two, *Caccorhinus* becomes superfluous.

There are five species of *Euparius* in the United States; three of these are reasonably familiar, one from Arizona is still undescribed and another, *E. paganus* Gyllenhal 1833, has long been considered a synonym of its sibling *E. marmoreus* (Olivier). *E. paganus* is commonest in Georgia and Florida but extends almost to Canada. *E. marmoreus* is by far the more abundant of the two, has a greater distribution which includes all of the known range of *paganus*, and is commonest in above Fall Line habitats. In Georgia and especially Florida the two species are very distinct; however in other regions occasional specimens with one or more intermediate features are found; these are considered interspecific hybrids.

1. Body pubescence black and white. D. C. to Florida west to Indiana and Texas ..... *E. lugubris* (Olivier)
   Body pubescence brown, mixed with yellow and/or gray, black and white present or absent 2
2. Elytra with paired dark spots and without a pale grayish spot behind each basal callus; pronotum very coarsely and confluently punctured. Arizona, New Mexico ..... *E. subtesselatus* (Schaeffer)
   Elytra with a pale gray or whitish mark behind each basal callus, often limited posteriorly by black; pronotum with small dense punctures 3
3. Mid-tibiae with two narrow pale rings; hind angle of pronotum rectangular with the angle rounded off, lateral carina straight; length (pronotal apex to elytral apex) 3.3 to 5.8 mm., average 4.7 mm. Massachusetts to Florida west to Wisconsin and Texas *E. paganus* Gyllenhal
   Mid-tibiae with one broad median pale ring; hind angle of pronotum slightly less than a right angle, lateral carina sinuate near base in both dorsal and lateral view; length (pronotal apex to elytral apex) 4.5 to 8.8 mm., average 6.7 mm. Quebec to Florida west to Manitoba and Texas ..... *E. marmoreus* (Olivier)

TRIGONORHINUS

Trigonorhinus Wollaston 1861. Ann. Mag. Nat. Hist. [3] 7 (art. 13): 102. Type: *Trigonorhinus pardalis* Wollaston 1861, by monotypy, equals *Brachytarsus areolatus* Boheman 1845.

Brachytarsus Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 405 and subsequent American authors (*nec* Schoenherr 1823).

Anthribulus Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 406. Type: *Anthribulus rotundatus* Leconte 1876, by monotypy.

Trigonorrhinus Gemminger and Harold 1872. Cat. Col. 9: 2745 (emendation).

Brachytarsoides Pierce 1930. Proc. U. S. Nat. Mus. 77 (art. 17): 29. Type: *Brachytarsus griseus* Leconte 1876, by original designation.

North American species.—*alternatus* (Say) 1827, *annulatus* (Carr) 1930, *franseria* (Barrett) 1931, *griseus* (Leconte) 1876, *irregularis* (Tanner) 1934, *limbatus* (Say) 1827, *nigromaculatus* (Schaeffer) 1906, *ornatellus* (Wolfrum) 1929, *plumbeus* (Leconte) 1876, *riddelliae* (Schaeffer) 1906, *rotundatus* (Leconte) 1876, *sticticus* (Boheman) 1833, *tomentosus* (Say) 1827, *vestitus* (Leconte) 1876, *cylindricus* (Dethlefsen) 1954, *elongatus* (Dethlefsen) 1954, *minor* (Dethlefsen) 1954, *nevadensis* (Dethlefsen) 1954, *nevadensis tigrinus* (Dethlefsen) 1954, *quadratus* (Dethlefsen) 1954, *quadratus nigrinus* (Dethlefsen) 1954, *rufodorsalis* (Dethlefsen) 1954, *vulgaris* (Dethlefsen) 1954.

Species examined.—*areolatus* (Boheman) 1845, *naviculus* (Jordan) 1907, *strigosus* (Jordan) 1907, *zeae* (Wolfrum) 1931, and all of those listed above.

The above generic synonymy was first proposed by Valentine (1957). In that work all the new world species listed variously under *Brachytarsus* Schoenherr, *Anthribulus* Leconte, and *Brachytarsoides* Pierce were combined with the Palearctic genus *Trigonorhinus*, which itself is usually listed as either a synonym or subgenus of *Brachytarsus*. There are, however, excellent morphological and biological grounds for considering *Trigonorhinus* distinct.

In the New World fauna, *Trigonorhinus* can be recognized by its rostrum, the dorsal surface of which is progressively narrowed from base to apex, and by the shape of the apex itself which has the central portion distinctly produced beyond the corners and slightly emarginate. Other genera may have an apically narrowed rostrum but then the beak is never distinctly longer in the center than at the sides. The generically distinct Old World species lack the apical prolongation of the rostrum, and in addition have the lobes of the third tarsal segment connate, while in *Trigonorhinus* the lobes are separate, the third tarsal segment thus appearing profoundly emarginate.

Other features of the genus are the basal thoracic carina, and the produced anterior portion of the pronotum which usually hides the head from dorsal view (provided the mouthparts are directed downward). The eyes vary from strongly emarginate to truncate on the side nearest the scrobes and are produced forward beneath them.

Trigonorhinus species are plant feeders like the majority of the family, but the generically distinct Old World species of *Anthribus* Forster 1771 (formerly *Brachytarsus* Schoenherr 1823) have larvae which are predaceous on the eggs of certain lecaniine scale insects.

I have in manuscript a revisionary study of *Trigonorhinus* that was completed just before the appearance of Dethlefsen's descriptions. Although I have since studied Dethlefsen's material a key to species is not advisable here, due to drastic differences in our species concepts and the resulting need for extended dis-

cussion and explanation of new synonymy. The revision and key will be published as soon as possible.

PHAENITHON

Phaenithon Schoenherr 1826. Curc. disp. method. 4: 37. Type: *Anthribus costatus* Dejean 1821 mss., by original designation, equals *Anthribus curvipes* Germar 1824.

Camaroderes Jekel 1855. Ins. Saund. 1: 85. Type: *Camaroderes viduus* Jekel 1855, by original designation and monotypy. Synonymy by Jordan 1906, Biol. Cent.-Amer. 4(6): 355.

Griburiosoma Schaeffer 1906. Trans. Amer. Ent. Soc. 32: 272. Type: *Griburiosoma platanum* Schaeffer 1906, by original designation and monotypy. NEW SYNONYMY.

North American species.—platanum (Schaeffer) 1906.

Species examined.—The above and *curvipes* (Germar) 1824, *semigriseus* (Germar) 1824, *figuratus* Gyllenhal 1833, *leopardinus* Fahraeus 1839, *pardalis* Jordan 1906, *ruficollis* Jordan 1904, *plagiatus* Boheman 1833.

This is a variable genus and therefore difficult to characterize. It has a large sinus in the eye on the side adjacent to the scrobes and the eye itself is subdorsal, finely faceted, and quite large. The antennae are very short and robust, ordinarily not extending half-way along the sides of the prothorax, and the club is very large, compact, and almost as long as the remaining segments. The lateral carina is incomplete, not reaching the apex; the transverse pronotal carina is weakly antebasal; and the scrobes are slightly produced below. Typically the rostrum is angulate above the scrobes then rounded from side to side along the apex with a large median apical emargination, and the mesosternal process is angulate laterally; however a few Neotropical species have only a shallow median emargination of the rostrum, or lack angulations above the scrobes, or have the mesosternal intercoxal process parallel-sided and apically truncate, or narrowed and apically rounded. Our United States species falls into the last category.

Phaenithon is best characterized by the deeply emarginate, finely faceted, subdorsal eyes; the very short, robust, large-clubbed antennae; the well-developed but incomplete lateral prothoracic carina.

Schaeffer's *Griburiosoma* is unquestionably a *Phaenithon*, similar in structure to the shorter and stouter members of the genus. The single species was collected by Schaeffer on the dead branches of Sycamore, in Miller's Canyon, Huachuca Mts., Arizona.

EUGONUS

Eugonus Schoenherr 1833. Gen. et Sp. Curcul. 1(1): 144. Type: *Eugonus virgatus* Gyllenhal 1833, by original designation and monotypy.

Schimatocheilus Schoenherr 1839. Gen. et Sp. Curcul. 5(1): 171. Proposed in synonymy of *Eugonus* Sch.

Phaenisor Motschoulsky 1874. Bull. Soc. Imp. Nat. Moscou 48(2): 240. Type: *Phaenisor albofasciatus* Motschoulsky 1874, by monotypy, probably equals *Eugonus subcylindricus* Fahraeus 1839. Synonymy by Jordan 1906, Biol. Cent.-Amer. 4(6): 350.

North American species.—An undescribed form.

Species examined.—The above and *subcylindricus* Fahraeus 1839, *decorus* Jordan 1906, *particolor* Jordan 1904.

The elongate-cylindrical species of this genus all have the lateral prothoracic carina extending to the apex or stopping barely short, the carina ending in an acute tooth. Our fauna has only one other genus with a complete lateral carina, *Araeoderes* Schaeffer 1906, however the latter is short and stocky, has very small, coarsely granulate eyes, a truncate rostral apex, and an evenly narrowing mesosternal process between the mid-coxae. *Eugonus* has large eyes, the rostrum is diagonally truncate on each side with a large semicircular median notch, the intercoxal process of the mesosternum is abruptly widened apically, the transverse carina is slightly antebasal, and the antennal scrobes are elongate, being produced towards the ventral midline.

The tribe Eugonini also includes *Phaenithon* Schoenherr, *Eugonodes* Jordan 1904, *Nemotrichus* Labram and Imhoff 1838 or 1842, and *Corrhecerus* Schoenherr 1826.

I have seen a single specimen of an undescribed species of *Eugonus* from the grounds of the Southwestern Research Station of The American Museum of Natural History near Portal, Arizona. It was taken at light by Dr. and Mrs. Henry Howden.

ORMISCUS

Ormiscus Waterhouse 1845. Ann. Mag. Nat. Hist. 16: 37. Type: *Ormiscus variegatus* Waterhouse 1845, by monotypy.

Hormiscus Gemminger and Harold 1872. Cat. Coleop. 9: 2738. Emendation of *Ormiscus*.

Entomops Gemminger and Harold 1872. Cat. Coleop. 9: 2738. Type: *Ormiscus variegatus* Waterhouse 1845, by present designation. Presented in the synonymy of *Hormiscus*.

Toxotropis Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 397. Type: *Toxotropis pusillus* Leconte 1876, designated by Jordan 1906, Biol. Cent.-Amer. 4(6): 362. Synonymy by Jordan 1904, Novit. Zool. 11: 286.

Gonops Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 398. Type: *Gonops fissunguis* Leconte 1876, by monotypy. Synonymy by Jordan 1904, Novit. Zool. 11: 286.

Eusphyrus Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 399. Type: *Eusphyrus walshii* Leconte 1876, by monotypy. NEW SYNONYMY.

North American species.—*saltator* Leconte 1876, *solidus* Pierce 1930, *sparsus* (Pierce) 1930, *simplex* (Pierce) 1930, *pusillus* (Leconte) 1876, *approximatus* (Leconte) 1876, *fasciatus* (Leconte) 1884, *floridanus* (Leng) 1916, *quercus* (Schaeffer) 1906, *irroratus* (Schaeffer) 1904, *quadrimaculatus* (Pierce) 1930, *submetallicus* (Schaeffer) 1904, *mitchelli* (Pierce) 1930, *albofasciatus* (Schaeffer) 1906, *sextuberculatus* (Schaeffer) 1906, *fissunguis* (Leconte) 1876, *eusphyroides* (Schaeffer) 1906, *schwarzi* (Pierce) 1930, *walshii* (Leconte) 1876, *arizonensis* (Schaeffer) 1906, *rectus* (Schaeffer) 1906.

Species examined.—All of the above except Leconte's *pusillus, approximatus, fasciatus,* and *fissunguis;* and also *angulatus* (Suffrian) 1870, *costifrons* Jordan 1904, *conis* Jordan 1924, *micula* Jordan 1924, and at least 30 undetermined Neotropical species.

The many species of this difficult genus can be distinguished from other Nearctic anthribids by their strongly notched eyes (on the side nearest the scrobes), their strongly curving pronotal carina which is closer to the base at the center than at the sides, their non-angulate intercoxal process of the mesosternum, and in all but one of our species, the absence of a lateral prothoracic carina.

In addition the rostrum is short and quadrate, rarely slightly widened apically, the apex usually truncate, rarely sinuate; the

frons is convex giving a "bulging forehead" appearance in lateral view; the antennae do not reach the shoulders of the elytra; the body is small and compact, maximum length (head excluded) being about 3.5 mm. in Central America, and 3.1 mm. in the United States.

I have searched in vain for a method for separating *Ormiscus* and *Eusphyrus* and have found that genitalia, male secondary sexual features, structure of the antennae, shape and position of transverse pronotal carina, and shape and carination of the pronotal hind-angles all vary independently from one another with the result that it is impossible to define clear-cut groups of species. There are species groups, of course, but each is connected to others by intermediate forms. Since I consider a genus to be a species or group of species discontinuously different from its nearest relatives, I feel that there is no other alternative than to unite all species under *Ormiscus*.

The tribe Ormiscini is well represented in the New World where eight genera all show the features outlined in the generic key. These are *Ormiscus* Waterhouse 1845, *Eugonops* Jordan 1904, *Cybosoma* Jordan 1906, *Araeoderes* Schaeffer 1906, *Anthrenosoma* Jordan 1904, *Paranthribus* Jordan 1904, and *Scymnopis* Jordan 1904; of these only *Ormiscus* and *Araeoderes* occur in the United States.

Unfortunately, males of *Ormiscus* are usually uncommon in collections; their presence helps simplify identifications due to the secondary sexual modifications of the hind and mid-tibiae. The seven species for which males have been studied (all compared with holotypes) are as follows: apex of mid-tibia with a small black lobe on inner angle—*saltator, solidus, simplex,* and *quadrimaculatus;* apex of mid-tibia with a small tubercle or tooth on inner angle—*eusphyroides* and *walshii;* apex of both mid- and hind-tibiae toothed on inner angle—*submetallicus.*

The species can also be grouped by the structure of the apices of the transverse pronotal carina. In *quercus, albofasciatus, eusphyroides, schwarzi, walshii, arizonensis,* and *rectus* the carinal apex turns ventrad, usually forming a projecting lobe at the hind angles of the prothorax; in *saltator, solidus, simplex, irroratus, mitchelli,* and *sextuberculatus* the carina simply ends without turning; and in *floridanus, quadrimaculatus, submetallicus,* and *mitchelli* the carina has a slight anteriorly directed hook.

ARAEODERES

Araeoderes Schaeffer 1906. Trans. Amer. Ent. Soc. 32: 275. Type: *Araeoderes texanus* Schaeffer 1906, by original designation and monotypy.

North American species.—*texanus* Schaeffer 1906.

Species examined.—*texanus* Schaeffer 1906.

The complete lateral carina and unusually coarse eye facets are diagnostic for *Araeoderes* as it now stands. However, only one species and a few specimens are known. The transverse carina of the prothorax is basal; the eye is emarginate adjacent to the antennal grooves, small, and very coarsely granulate—about 45–50 ommatidia in the specimen seen; the rostrum is very short and broad, parallel sided, and apically truncate.

This genus belongs near the Neotropical *Anthrenosoma* Jordan 1904, from which it can be separated by its coarsely granulate eye and the absence of the strongly oblique dorsal lobe of the same organ. The shape of the rostrum is suggestive of *Ormiscus* Waterhouse 1845.

PHOENICOBIELLA

Phoenicobiella Cockerell 1906. Ent. News 17(7): 243. Nomen novum for *Phoenicobius* Leconte *nec* Moerch.

Phoenicobius Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 400. Type: *Phoenicobius chamaeropis* Leconte 1876, by monotypy. *Nec Phoenicobius* Moerch 1852, in Mollusca.

North American species.—*chamaeropis* (Leconte) 1876, *schwarzi* (Schaeffer) 1906.

Species examined.—The above.

This is the only genus in our fauna with the lobes of the third tarsal segments greatly enlarged and fused so that the fourth segment arises from the base of the third while the elongate fifth lies along the dorsal surface of the third and projects beyond it.

This genus and *Toxonotus* Lacordaire 1866 form a very distinct unit in the New World. Both have the transverse carina of the prothorax basal, the lateral carinae extending anteriorly past the middle, and a deep puncture or angulate groove at the base of the rostrum which limits or interrupts a longitudinal rostral carina. This groove is sometimes partially obscured by the pubescence but it is always deep, sharply limited, and can be in

the form of a transverse curving pit, or a V, or an X with short arms. These genera also have the mesosternal process dilated apically, and the eyes truncate or emarginate on the side adjacent to the scrobes. The Palearctic representative of the group is usually called *Platystomos* Hellwig 1792. It shares all of the above features and future studies may show that it is synonymous with *Toxonotus*. This complex needs considerably more study. Some pertinent nomenclatorial information is given by Jordan (1931).

In the New World fauna, *Phoenicobiella* is the most distinctive member of the complex. In addition to the connate lobes of the third tarsal segments, it has the eyes emarginate; the antennae elongate and the antennal club scarcely differentiated from the remainder, reaching past the humerae in both sexes, considerably longer than body in some males. Erect pubescence is absent on both body and legs; and the male genitalia have the dorsal plate of the aedeagus divided into two by a longitudinal clear area, while the female genitalia have the coxites rounded apically, without teeth and fused with the valvifers. The short, truncate, peg-like stylus might be mistaken for a tooth but the readily visible articulation with the coxite shows that it is a separate and distinct structure. In *Toxonotus* the males have the dorsal plate of the aedeagus evenly sclerotized, while the female coxites are apically toothed, and coxite and valvifer are separated by a clear area that appears membranous.

Our two species key out as follows:

1. Dorsal pubescence clearly tesselated with gray, straw, light and dark brown; Georgia, Florida, perhaps Louisiana
   P. chamaeropis (Leconte)

   Dorsal pubescence dense pale brown, vaguely and irregularly mottled with sparser patches of gray or darker brown; Texas
   P. schwarzi (Schaeffer)

TOXONOTUS

Toxonotus Lacordaire 1866. Genera des Coléoptères 7: 575. Type: *Anthribus fascicularis* Schoenherr 1833, by monotypy.

Anthribus Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 402. *Nec Anthribus* Forster 1771. NEW SYNONYMY.

Neanthribus Jordan 1906. Biologia Centrali-Americana 4(6): 341. Type: *Neanthribus championi* Jordan 1906, by original designation. NEW SYNONYMY.

Neanthribius Leng and Mutchler 1914. Bull. Amer. Mus. Nat. Hist. 33 (art. 30): 481. Typographical error.

Pseudanthribus Pierce 1930. Proc. U. S. Natl. Mus. 77(7): 24. Type: *Anthribus cornutus* Say 1831, designated by Anderson, 1947, Ann. Ent. Soc. Amer. 40(3): 504. NEW SYNONYMY.

North American species.—*bipunctatus* (Schaeffer) 1904, *cornutus* (Say) 1831, *fascicularis* (Schoenherr) 1833, *lividus* (Leconte) 1876, *penicellatus* (Schaeffer) 1904.

Species examined.—All of the above and *apicalis* (Jordan) 1906, *bidens* (Oliver) 1795, *championi* (Jordan) 1906, *mendax* (Wolfrum) 1930, *segregus* (Jordan) 1906, *vagus* (Horn) 1894.

As here constituted, *Toxonotus* can be recognized by the presence of a single or double carina on the upper surface of the rostrum which ends abruptly at the rostral base in a small, deep, irregularly shaped pit or transverse cavity, and the fact that the lobes of the third tarsal segment are separate rather than fused.

Both the similarities and differences between this genus and *Phoenicobiella* are discussed under the latter. The only other feature requiring comment is the presence in all our *Toxonotus* except *T. lividus* (Lec.) of tufts of erect scales on pronotum and elytra, of an erect fringe of long scales around the elytral margin, and of many erect scales on the legs, especially on the tibiae, giving a bottle-brush effect.

The synonymy of *Neanthribus* is based on the fact that structural differences between this entity and *Toxonotus*—such as degree of eye sinuation, pronotal carination anterior to the lateral carina, and antennal length—all show continuous variation, thus making it impossible to draw a sharp line between the two groups. In addition, the discontinuous features such as the presence or absence of a tarsal spine, or erect scales, or a uniform rather than variegate color pattern, each alligns the species in different groups. Picking one of these features and stating that it alone delimits two genera means that one must overlook all the other features which indicate one variable genus. In two recent papers (1955 a and b) I have used the presence of a tarsal spine to distinguish *Toxonotus* as separate from *Neanthribus*. I have since had the opportunity to study critically several undescribed West Indies species in the complex (to be described in a revision

of that fauna) and find that a dichotomy based on the presence or absence of this spine splits the species into two groups which are not supported by additional features. In fact, as mentioned above, each variable characteristic in the complex contradicts each other character. It is thus necessary to unite the two "genera" and use the tarsal spine merely as one of several features useful for species descrimination. The current North American species of *Toxonotus* as now understood can be recognized as follows:

1. Pronotum, elytra, and tibiae without tufts or numerous erect scales; North Carolina to Florida to Mississippi, also Missouri and Illinois *T. lividus* (Leconte)

   Pronotum and elytra with tufts, and tibiae with numerous erect scales (these can be plastered down or abraded in some specimens) 2
2. First segment of all tarsi with a dorsal apical spine intermixed with long pubescence; Florida to Cuba ..... *T. fascicularis* (Schoenherr)

   First segment of all tarsi without a spine 3
3. Apical margin of pronotum without erect tufts of scales; sides of prothorax with a longitudinal ridge just anterior to apex of lateral carina; Texas ..... *T. bipunctatus* (Schaeffer)

   Apical margin of pronotum with two tufts or erect scales in addition to the three discal tufts; sides of prothorax evenly convex anterior to apex of lateral carina 4
4. Sutural interspace with diagonal dark tessellations; large median tuft of third elytral interspace conspicuously pale, this color continuing posteriorly as a progressively narrowed line; Texas *T. penicellatus* (Schaeffer)

   Sutural interspace with transverse tessellations; large median tuft of third elytral interspace mostly dark (occasionally pale on posterior margin) no light streak running posteriorally from the tuft; New Jersey to Florida west to Indiana and Texas ..... *T. cornutus* (Say)

BREVIBARRA

Brevibarra Jordan 1906. Biologia Centrali-Americana 4(6): 312. Type: *Brevibarra scotosagis* Jordan 1906, by original designation and monotypy.

Tropideres Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 395. In part, *nec* Schoenherr 1823.

North American species.—*rectus* (Leconte) 1876. **NEW COMBINATION.**

Species examined.—The above.

Within the entire eyed group of genera in the Anthribinae, this genus has the coarsest eye facets of all, only eleven to twelve longitudinal rows counted across the greatest width. It differs from the related genus *Piesocorynus* Dejean 1833, not only in the unusually coarse eye facets but also by virtue of its truncate elytral bases and short third antennal segment which, although occasionally longer than four, is usually shorter or subequal to two. In *Piesocorynus* the third segment is usually twice the length of the second. *Brevibarra* also has an antebasal prothoracic carina, and a lateral carina which extends about ⅓ to the apex of the prothorax.

In his original description, Jordan stresses the narrow, apically angulate, intercoxal process of the mesosternum. However in the eight species of *Brevibarra* before me, seven of which are undescribed, some have the apex angulate, others are subtruncate, and still others vary from specimen to specimen so that it is impossible to determine which condition is more characteristic.

Brevibarra scotosagis Jordan is the only type species in the Piesocorynini which I have not seen. However, since the other New World genera have been studied, many from material determined by Dr. Jordan, I feel that the new combination *Brevibarra rectus* (Leconte) is valid, first because I can rule out all other related genera, and second because the group of species I have seen from Mexico, United States, Jamaica, and Hispaniola all fit the essential features of Jordan's description. Needless to say the diagnosis of *Brevibarra* used in the present work is based on *B. rectus* (Lec.) and the seven undescribed species, and not on Dr. Jordan's original description. There are two reasons for this: first, the original description does not mention some of the features which I have found useful; and second, I find it difficult to describe through someone else's words an animal I have never seen.

Brevibarra rectus has had a varied nomenclatorial history. Originally described by Leconte in *Tropideres*, it was transferred to *Goniocloeus* Jordan by Wolfrum (1938: 71) and then fifteen years later to *Piesocorynus* Dejean (Wolfrum 1953: 26, 7). *B. rectus* is a Coastal Plain species ranging from New Jersey to Florida to Texas.

PIESOCORYNUS

Piesocorynus Dejean 1833. Cat. Col. ed. 2, p. 235. Type: *Euparius dispar* Gyllenhal 1833, by monotypy.

Piezocorynus Schoenherr 1839. Gen. et Sp. Curc. 5(1): 250. Emendation.

Camptotropis Jekel 1855. Ins. Saund. 1, p. 136. Type: *Camptotropis gracilicornis* Jekel 1855, by original designation. Synonymy by Jordan 1904, Novit. Zool. 11: 276.

North American species.—*mixtus* Leconte 1876, *moestus* (J. E. Leconte) 1824, *plagifer* Jordan 1904, *virginicus* Leng 1918, *tesselatus* Schaeffer 1906.

Species examined.—*dispar* (Gyllenhal) 1833, *gracilicornis* Jekel 1855, *alternans* Jordan 1904, *atratus* Jordan 1906, *occipitalis* Jordan 1906, *pullinus* Jordan 1937, and all of our United States species.

In the New World fauna there is a group of eight genera of which two, *Piesocorynus* and *Brevibarra* Jordan, enter the United States. In the absence of the various key features of other genera these two can be recognized by their oval, entire, and coarsely faceted eyes. *Piesocorynus* has from 14 to 24 longitudinal rows of facets in each eye, and the third antennal segment is longer than either the second or fourth. Although distinctive in our fauna these two features are not sufficient when extralimital genera are considered. Other characteristics are: the lobed elytral bases (overhanging the base of the pronotum); the broad, more or less rounded apex of the intercoxal process of the mesosternum; the normal pygidium and tarsi; the absence of an apical curving tooth on the mid-tibiae of males (present in male *P. virginicus*). Most other features are variable—as the lateral carina which extends for about ½ to ¾ the length of the prothorax and the transverse carina which varies from virtually basal to clearly antebasal and can be either concave or convex.

Our species have been keyed by Buchanan *in* Pierce (1930). A second key, slightly modified, is presented below.

1. Pronotum with a large rounded median callus, and with basal punctures forming fine irregular transverse rugae; elytra with large pale sutural patch, broadest behind basal callus and narrowed posteriorly to include 3 interspaces on each side, the third interspace tesselated with black; New York to Illinois, south to Argentina, no Florida records ..... *P. plagifer* Jordan

Pronotum with just an indication or no median callus, and without transverse basal rugae; elytra with sutural region similar to sides or darker, no large pale patch 2

2. Elytra blackish with gray tesselations or tinge, without yellow or brown pubescence; New Jersey to Florida to Texas; north to southern Ohio in the Coastal Plain ..... *P. moestus* (J. E. Leconte)

Elytra with brown or yellow tesselations 3

3. Disc of elytra with first and second interspaces solid black; Maryland to Florida to Texas to southern Ohio in the Coastal Plain *P. virginicus* Leng

Disc of elytra with first interspace tesselate, and second solid gray or brown 4

4. First segment of all tarsi more brown than gray; pale antemedian ring on tibiae narrower than tibial diameter; Arizona *P. tesselatus* Schaeffer

First segment of all tarsi more gray than brown; pale antemedian ring on tibiae wider than tibial diameter; New York to Indiana south to Florida and Texas ..... *P. mixtus* Leconte

TROPIDERES

Tropideres Schoenherr 1823. Isis von Oken, Heft 10, p. 1135. Type: *Anthribus albirostris* Fabricius 1801, by original designation, equals *Anthribus albirostris* Herbst 1784.

Tropidoderes Gemminger and Harold 1872. Cat. Col. 9: 2733. Emendation.

Gonotropis Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 393. Type: *Gonotropis gibbosus* Leconte 1876, by monotypy, equals *Anthribus dorsalis* Thunberg 1796. NEW GENERIC AND SPECIFIC SYNONYMY.

Eurymycter Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 394. Type: *Macrocephalus fasciatus* Olivier 1795, by monotypy. NEW SYNONYMY.

North American species.—dorsalis (Thunberg) 1796, *fasciatus* (Olivier) 1795, *latifascia* (Pierce) 1930, *tricarinatus* (Pierce) 1930.

Species examined.—albirostris (Herbst) 1784, and all of the above.

There are at least half a dozen works which mention or restate the original comment by Jordan (1904, p. 254) that true *Tropideres* do not occur in America. Despite these misstatements our species can be recognized by their broad, parallel sided, and truncate mesosternal processes, the width being greater than that of a pro-coxa, in combination with the finely faceted, entire, subdorsal, non-protruding eyes. In addition, our species have an

angulate groove (faint in *dorsalis*) on the disc of the prothorax, and dense white pubescence on the face. They also have an antebasal thoracic carina, and a rostrum which is widest at the apex.

As mentioned in the synonymy, our species known as *Gonotropis gibbosus* Leconte is, in reality, identical with the well known *Tropideres dorsalis* (Thunberg) of Europe. On the other hand *Eurymycter* appears to be a complex of sibling species dissimilar in very minor details from the European forms, although its generic characters fit *Tropideres* perfectly. It might be convenient to use *Eurymycter* as a subgenus under *Tropideres* but I feel that it is preferable to emphasize the relationship by combining the two.

It is interesting to note that in his reclassification of the anthribids Dr. Pierce (1930) placed *Gonotropis* and *Eurymycter* in a new tribe (the Eurymycterini) distinct from the Tropiderini. This was due, no doubt, to his erroneous concept of *Tropideres*. Since *Gonotropis* and *Eurymycter* are synonyms of *Tropideres*, the tribe Eurymycterini of Pierce 1930 becomes a synonym of the Tropiderini of Bedel 1883.

The tribe has only the single genus in the New World (it is possible that *Sistellorhynchus* Blanchard 1851 from Chile also belongs here) but is abundantly represented in the Old World by such genera as *Acorynus* Schoenherr 1833, *Litocerus* Schoenherr 1833, *Cedus* Pascoe 1860 and related forms.

Our four North American species of *Tropideres* are keyed out below. The variant described by Pierce (1930) as *E. bicarinatus* is a specimen of *fasciatus* with the lateral rostral carinae more closely placed, and with the median carina present at the base only.

1. Elytral patch of pale pubescence anterior, not reaching side margins. Holarctic, south to Pennsylvania and the Pyrenees Mountains *T. dorsalis* (Thunberg)

   Elytral patch of pale pubescence above apical declivity and reaching side margins 2

2. Abdominal pubescence brown in center, usually with some gray or white on the sides. Quebec to Alabama, west to Wisconsin *T. tricarinatus* (Pierce)

   Abdominal pubescence solid white or with brown lateral spots 3

3. Hind tibiae with a broad median pale ring, the apex solid brown; only third elytral interval strongly elevated; transverse fascia of elytra broad and comparatively straight edged. Nova Scotia to New York *T. latifascia* (Pierce)

Hind tibiae with a narrow median pale ring, the apex brown spotted with white; third, fifth, and seventh elytral intervals elevated; transverse fascia of elytra narrow and with very irregular edges. Quebec to Florida west to Michigan and Texas, also Utah and Idaho to Oregon and British Columbia ..... *T. fasciatus* (Olivier)

GONIOCLOEUS

Goniocloeus Jordan 1904. Novit. Zool. 11: 260. Type: *Goniocloeus baccatus* Jordan 1904, by original designation.

Straboscopus Lacordaire 1866, in part. Gen. Coleop. 7: 533. Type: *Straboscopus riehlii* Lacordaire 1866, by present designation.

Tropideres Leconte 1876, in part. Proc. Amer. Philos. Soc. 15(96): 395, *nec* Schoenherr 1823.

North American species.—*bimaculatus* (Olivier) 1795, *barberi* (Pierce) 1930.

Species examined.—The above and *tholerus* Jordan 1906, *umbrinus* Jordan 1904, *orbitalis* (Lacordaire) 1866, *planipennis* (Kirsch) 1873, *pumilis* Jordan 1906, *ornaticeps* Jordan 1906, *insignis* Jordan 1906.

The two genera *Goniocloeus* and *Trachytropis* have finely faceted eyes (more than 25 longitudinal rows of facets), antebasal prothoracic carinae, flattened rostra, protruding and strongly oblique eyes, a transverse groove or depression at base of prementum, well developed lateral carinae and carinulae, and a lateral angulation near the apex of the intercoxal process of the mesosternum. They differ in that *Goniocloeus* has the rostral width (at the *narrowest* point near the base) more than twice the least interocular width, the lateral carina is not strongly tuberculate at its apex, and the pronotum is either convex or with paired depressions on either side of the elevated hind-line. In *Trachytropis* the minimum rostral width is less than twice the least interocular width (in other words, the eyes are much farther apart), the lateral carina ends in a strong laterally projecting tubercle, and the pronotum has a large irregular median depression limited anteriorly by a raised, inverted V, the apex of which attains the anterior margin.

The name *Goniocloeus* is used with some reservation, for it seems to include two complexes of species. The genotype and related species are large tuberculate insects. Our *bimaculatus, barberi,* and other tropical species are small, more elongate, and only lightly sculptured. The group of small species appears to be congeneric with the European *Ulorhinus bilineatus* (Germar) 1818. Unfortunately I have no assurance that *bilineatus* is correctly allocated to genus, for the European classification is even more chaotic than ours. The genotype of *Ulorhinus* is *U. funebris* Sharp 1891, by monotypy, from Japan. I have not seen specimens of *funebris* and must therefore withhold judgment on the true identity of *Ulorhinus.* Also, I have not seen sufficient New World species of the complex to be certain that the two species groups of *Goniocloeus* are separable at the generic level. Since all the New World members of the complex are currently placed in *Goniocloeus,* it is preferable to maintain the status quo with the understanding that future studies may reveal that *Ulorhinus* Sharp has priority for the small species.

We have only one species in the United States, as I consider "*Tropideres*" *barberi* Pierce a poorly differentiated subspecies of *bimaculatus* (Olivier). It ranges from Massachusetts to Wisconsin, south to Georgia and Texas. There seem to be no peninsular Florida records.

TRACHYTROPIS

Trachytropis Jordan 1904. Novit. Zool. 11: 266. Type: *Trachytropis asper* Jordan 1904, by original designation and monotypy.

North American species.—arizonicus (Sleeper) 1954. **NEW COMBINATION.**

Species examined.—asper Jordan 1904.

This genus is closely related to *Goniocloeus* Jordan. Its basic recognition features are discussed under that taxon.

It appears reasonably certain that the species described by Sleeper (1954) as *Ischnocerus arizonicus* actually belongs in *Trachytropis.* Even a cursory reading of the original description will show that it cannot possibly be an *Ischnocerus.* The flattened, spatulate rostrum, short male antennae, small, covered scrobes, pointed scutellum, and strongly sinuate elytral base are

all features which rule out *Ischnocerus*, and these, together with the prothoracic sculpture, strongly suggest *Trachytropis*. A letter to Dr. Sleeper elicited the following information (Sleeper, *in lit.* January 16, 1956) ". . . from further studies of the type [of *arizonicus*] and communications with Dr. Jordan I feel that I am very safe in saying that it is actually a *Trachytropis*."

Sleeper's description of the elytral sculpture of *arizonicus* will confuse some students, as he numbers the elytral interspaces in such a way that the even numbered ones are tuberculate and the odd ones smooth. This is contrary to standard usage in which the intervals of anthribids are so counted that the odd ones have the sculpture (if present) and the even ones are smooth. It is customary to not count the short scutellar interval, and to consider interval one as that which parallels the outside of the scutellar interval and then moves over and joins it at the suture after the scutellar stria drops out. By this system the main tubercles fall on the third and fifth interspaces. Sleeper, however, has called these the second and fourth. The single known specimen is from the Huachnca Mts., Arizona.

GYMNOGNATHUS

Gymnognathus Schoenherr 1826. Curc. disp. method. 4: 4, 37. Type: *Anthribus ancora* Germar 1824, by original designation and monotypy.
Analotes Schoenherr 1839. Gen. et Sp. Curcul. 5(1): 198. Type: *Analotes discoideus* Fahraeus 1839, by original designation and monotypy. Synonymy by Jordan 1937, Novit. Zool. 40: 212.

North American species.—chiricahuae Sleeper 1954.

Species examined.—chiricahuae Sleeper 1954, *ada* Jordan 1904, *leucomelas* Jordan 1904, *ophiopsis* Dalman 1833, *pulcher* Jordan 1906, *tenuis* Jordan 1895, and five undetermined species from Central and South America.

This large neotropical genus (88 species) can be recognized at a glance by the structure of the scutellar notch. It is the only North American genus in which the elytral base is produced towards the midline anterior to the scutellum, thus partially enclosing its anterior surface. In addition, the eyes are entire and finely faceted, the postmentum is longitudinally carinate, the transverse pronotal carina is antebasal, the elytra are without a

basal margin and are produced anteriorly over the base of the pronotum, and the body at mesothorax is unusually deep dorsoventrally.

Gymnognathus shares the peculiar elytral construction with *Systaltocerus* Labram and Imhoff 1838 or 1842, *Domoptolis* Jordan 1904, and *Strabopsis* Jordan *in* Wolfrum 1953—the four constituting a natural and closely related group, the tribe Gymnognathini.

Sleeper's figure (1954, fig. 1) of the allotype of *Gymnognathus chiricahuae* shows the scutellum resting in a simple V-shaped notch. This was an oversight, for a pair of paratypes sent by Dr. Sleeper show the semi-enclosed scutellum characteristic of the genus. In the same work the species is described as having simple tarsal claws—the two paratypes have claws with a robust basal tooth. The only key to species is that of Jordan (1937, p. 232). However it should be remembered that several species have since been described.

STENOCERUS

Stenocerus Schoenherr 1826. Curc. disp. method. 4: 4, 39. Type: *Anthribus fulvitarsis* Germar 1824, by original designation and monotypy.

North American species.—longulus ssp. *mexicanus* Jekel 1855.

Species examined.—fulvitarsis (Germar) 1824, *longulus* Jekel 1855, *varipes* Fahraeus 1839.

This genus can be recognized by the whorls of erect hairs on segments 4–8 of the antennae. The club segments (9–11) have the erect hairs more median than apical, except for segment 11 which has both. Identification can be assured by the following. The eye is entire, oval, and lateral. The prothoracic carina is antebasal but becomes almost basal at the mid-line. The rostrum is flattened, strongly widened at the apex, and the antennal insertions are invisible from above. The mesosternal process is broad and parallel-sided at the base. The apex of the process is variously modified from species to species, being strongly convex or variously excavated in the center (thus appearing bituberculate).

Stenocerus holds an isolated position. In our fauna it is probably closest to *Allandrus*, but the relationship is at best a distant

one, the major points of similarity resting solely on the shape and appearance of the head and rostrum.

The record for *Stenocerus longulus mexicanus* is the first for the United States. It is included here through the courtesy of Dr. George B. Vogt who collected three males. Two of them bear the data "S.W. Hidalgo Co., Texas E. x-20-46 George B. Vogt Under bark Celtis laevigata Wild. felled 18 months ago." The third bears the same data except it was collected v-30-47 and bears no statement of the age of the tree.

Sleeper (1953) described *Stenocerus knullorum* from Hidalgo Co., Texas iv-7-50 collected by D. J. and J. N. Knull. A letter from Dr. Sleeper (Dec. 28, 1953) states that the two specimens, male and female, were taken " in a small pocket in the bend of the Rio Grande directly south of Mission, Texas ".

Thanks to the generosity of Dr. Josef N. Knull of The Ohio State University, I have recently examined the allotype of *S. knullorum*. It is identical with *Stenocerus longulus mexicanus*, a widespread Central American insect. The original description and figure are both very misleading. The following statements in quotes are from the original description (Sleeper 1953: 114). To each is added comments based on the allotype. " Black " is dark brown; " subcylindrical " is with pronotal disc and elytral suture depressed; " rostrum . . . [with] lateral carina on each side " refers not to the rostral edges but to a pair of carinae lateral to the median carina and about half way to the side margins; " antennal grooves . . . about midway between eye and base of mandible " are closer to mandibles; antennae with " all segments with long bristles " does not fit the first three segments which have short or are without bristles; " scutellum prominent " is in the sense of readily visible rather than projecting; " sutural stria " equals scutellar stria; strial punctures " approximately two diameters apart " applies only in the depressed sutural area and even there they are usually more widely spaced; " beneath black " is brown. Sleeper (1954: 118) further states " in general appearance this resembles *S. platalea* Jordan from which it may be separated by the shorter prosternal lamella of the latter "—a simpler point is that *platalea* lacks the well-developed median rostral carina of the Texas insect; " nearest *longulus* Jekel, but does not have the

mesosternal process bituberculate or the prosternal lamella notched between the coxae"—these last two features are variable from indivdual to individual and also show a slight geographic trend towards heavy development in South America and lighter development in Central America and Mexico Concerning the "bituberculate" apex of the intercoxal process of the mesosternum of *longulus*, very few specimens are actually bituberculate. Usually they are strongly to weakly bi-conical and in the Texas specimens just strongly biconvex. There is no discontinuity between Texas and more southern populations. As for the absence of a notch on the intercoxal lamella of the prosternum, the allotype of "*knullorum*" has a weak notch, no less obscure than in specimens of *mexicanus* from Veracruz and Chiapas. Strongly notched specimens are more characteristic of the typical subspecies in South America. Sleeper's illustration (1953, pl. 1) of *knullorum* shows a strongly spotted insect. However his allotype has markings much more obscure. It resembles the illustration of *S. longulus mexicanus* in the Biologia (Jordan 1906, pl. 11, fig. 5). *Stenocerus knullorum* Sleeper 1953 is therefore a synonym of *Stenocerus longulus* ssp. *mexicanus* Jekel 1855, **NEW SYNONYMY.**

ALLANDRUS

Allandrus Leconte 1876. Proc. Amer. Philos. Soc. 15(96): 396. Type: *Allandrus bifasciatus* Leconte 1876, by monotypy.

North American species.—*bifasciatus* Leconte 1876, *brevicornis* Frost 1920, *populi* Pierce 1930.

Species examined.—The above, and *undulatus* (Panzer) 1795, *therondi* (Tempere) 1954.

This is the only New World genus with eyes so wide apart. The minimum interocular distance is always greater than the minimum width of the rostrum (near the base). Other features of the genus are the flat, spatulate rostrum (males of the type species have a high median keel or carina); the strongly antebasal prothoracic carina; the reticulate-punctate pronotum; and the entire, lateral, slightly oval eyes.

This genus and its relatives will probably be found to have a much wider distribution than present catalogues would indicate.

At least two New Zealand insects, *Plintheria brouni* (Sharp) and *sharpi* (Broun), appear to be very close. (These two species are listed twice in Wolfrum's *Coleopterorum Catalogus* pars 102 (1929) under *Plintheria* and *Brachytarsus*).

The genus *Plintheria* was described by Pascoe in 1859. The type species, *Plintheria luctuosa* Pascoe (by monotypy), differs from Nearctic and Palearctic *Allandrus*, and to a lesser extent from the two New Zealand species, by its very large and finely faceted eyes which are dorsal and quite close together. The minimum interocular width is appreciably less than the minimum width of the rostrum despite the fact that the rostrum is very narrow. In other respects, *luctuosa* is essentially similar to our *Allandrus* species. The two New Zealand forms have eyes intermediate between *Allandrus* and *Plintheria* but are closest to the latter. Since other Pacific species have not been seen, it is impossible to state whether or not the size and the degree of separation of the eyes is a valid generic character. If there is no true discontinuity between the two types of eyes, *Allandrus* will have to be replaced and all the American, European, and Pacific species will then be united in *Plintheria*.

Of the five species of *Allandrus* examined for this work, two (*undulatus* Panzer and *therondi* Tempere) are Palearctic. In European literature they are usually listed as belonging to the genus *Tropideres* subgenus *Enedreytes*. This is as grotesque a combination of names as could be imagined for the genera have practically nothing in common. The type species of *Enedreytes*, *E. hilaris* Fahraeus 1839, is a close relative of *Discotenes*. Its very thick rostrum (from dorsal to ventral surfaces) is totally different from the extremely compressed and flattened rostrum of *Allandrus*.

The three North American species can be separated by the following features.

1. Tarsal claws simple; New Hampshire to Michigan, Alberta to Arizona *A. populi* Pierce

   Tarsal claws with a small median tooth 2

2. Supra-scrobal carina absent or not surpassing the posterior margin of scrobe; male with rostrum and front tibiae normal; Maine to New Jersey, west to Alberta and Illinois, also California *A. brevicornis* Frost

Supra-scrobal carina surpassing posterior margin of scrobe; male with a median raised crest on rostrum and the front tibiae strongly curved and bent; Quebec to Virginia, west to Iowa .. *A. bifasciatus* Leconte

A CHECKLIST OF THE ANTHRIBIDAE NORTH OF MEXICO

Family Anthribidae

Subfamily Choraginae

Tribe Araecerini

Araecerus Schoenherr 1823: 1135.
Araeocerus Schoenherr 1839: 273.
Araeosaurus Walker 1859: 262.
fasciculatus (DeGeer) 1775: 276.
cacao (Fabricius) 1775: 64.
coffeae (Fabricius) 1801: 411.
griseus (Stephens) 1831: 211.
japonicus (Thunberg) 1815: 122.
peregrinus (Herbst) 1797: 168.
seminarius Chevrolat 1871: 7.

Acaromimus Jordan 1907: 381.
Acaropsis Jordan 1907: 382.
Xenorchestes Motschoulsky 1873: 261, in part, *nec* Wollaston 1854: 417.
Euxenus Blatchley 1920: 162, in part, *nec* Leconte 1876: 409.
americanus (Motschoulsky) 1873: 251.
piceus Blatchley 1920: 162, *nec* Leconte 1878: 434.

Tribe Choragini

Choragus Kirby 1818: 447.
Alticopus Villa 1833: 35.
Holostilpna Jordan 1907: 382.
harrisi Leconte 1878: 626.
nitens Leconte 1884: 32.
sayi Leconte 1876: 408.
zimmermanni Leconte 1876: 408.

Euxenus Leconte 1876: 409.
ater Blatchley 1928: 238.
punctatus Leconte 1876: 409.

Euxenulus Valentine (new genus).
piceus (Leconte) 1878: 434.

Subfamily Anthribinae

Tribe Discotenini

Discotenes Labram & Imhoff 1838–1842, no. 49.
Phanosolena Schaeffer 1904: 234.
arizonica (Schaeffer) 1906: 269.
nigrotuberculata (Schaeffer) 1904: 235.

Ischnocerus Schoenherr 1839: 191.
Meconemus Labram & Imhoff 1838–1842, no. 40.
angulata Martin 1930: 71.
infuscatus Fahraeus 1839: 192.
tuberculatus (Labram & Imhoff) 1838–1842, no. 40.

Tribe Euparriini

Euparius Schoenherr 1823: 1135.
Cratoparis Dejean 1833: 235.
Caccorhinus Sharp 1891: 321.
lugubris (Olivier) 1795 genus 80, no. 17.
notatus (Say) 1827: 248.
marmoreus (Olivier) 1795 genus 80, no. 16.
lunatus (Fabricius) 1801: 409.
albifrons (Boheman) 1829: 118.
paganus Gyllenhal 1833: 142.
subtesselatus Schaeffer 1906: 274.
new species

Tribe Anthribini

Trigonorhinus Wollaston 1861: 102.
Trigonorrhinus Gemminger & Harold 1872: 2745.
Brachytarsus Leconte 1876: 405, *nec* Schoenherr 1823: 1135.
Anthribulus Leconte 1876: 406.
Brachytarsoides Pierce 1930: 29.
alternatus (Say) 1827: 250.
annulatus (Carr) 1930: 279.
cylindratus (Dethlefsen) 1954: 53.
elongatus (Dethlefsen) 1954: 54.
franseria (Barrett) 1931: 188.
griseus (Leconte) 1876: 405.
irregularis (Tanner) 1934: 285.
limbatus (Say) 1827: 250.
minor (Dethlefsen) 1954: 61.
nevadensis (Dethlefsen) 1954: 55.
ssp. *tigrinus* (Dethlefsen) 1954: 56.
nigromaculatus (Schaeffer) 1906: 277.

ornatellus (Wolfrum) 1929: 99.
ornatus (Schaeffer) 1906: 276, *nec* Sharp 1876: 437.
plumbeus (Leconte) 1876: 406.
quadratus (Dethlefsen) 1954: 59.
ssp. *nigrinus* (Dethlefsen) 1954: 60.
riddelliae (Schaeffer) 1906: 277.
rotundatus (Leconte) 1876: 407.
rufodorsalis (Dethlefsen) 1954: 58.
sticticus (Boheman) 1833: 172.
variegatus (Say) 1827: 251, *nec* Fourcroy 1785: 136.
obsoletus (Fahraeus) 1839: 167.
strictus (Zimmerman) 1936: 191.
tomentosus (Say) 1827: 251.
brevis (Fahraeus) 1839: 168.
paululus (Casey) 1884: 194.
vestitus (Leconte) 1876: 406.
vulgaris (Dethlefsen) 1954: 57.

Tribe Eugonini

Phaenithon Schoenherr 1826: 37.
Camaroderes Jekel 1855: 85.
Griburiosoma Schaeffer 1906: 272.
platanum (Schaeffer) 1906: 273.

Eugonus Schoenherr 1833: 144.
Schimatocheilus Schoenherr 1839: 171.
Phaenisor Motschoulsky 1874: 240.
new species

Tribe Ormiscini

Ormiscus Waterhouse 1845: 37.
Hormiscus Gemminger & Harold 1872: 2738.
Entomops Gemminger & Harold 1872: 2738.
Toxotropis Leconte 1876: 397.
Gonops Leconte 1876: 398.
Eusphyrus Leconte 1876: 399.
albofasciatus (Schaeffer) 1906: 271.
approximatus (Leconte) 1876: 398.
arizonensis (Schaeffer) 1906: 272.
eusphyroides (Schaeffer) 1906: 270.
fasciatus (Leconte) 1884: 32.
fissunguis (Leconte) 1876: 398.
floridanus (Leng) 1916: 28.
irroratus (Schaeffer) 1904: 233.
mitchelli (Pierce) 1930: 10.
pusillus (Leconte) 1876: 398.

quadrimaculatus (Pierce) 1930: 9.
quercus (Schaeffer) 1906: 270.
rectus (Schaeffer) 1906: 271.
saltator Leconte 1876: 397.
angulatus Pierce 1930: 6, *nec* Suffrian 1870: 187.
schwarzi (Pierce) 1930: 28.
sextuberculatus (Schaeffer) 1906: 269.
victoriensis (Pierce) 1930: 11.
simplex (Pierce) 1930: 8.
solidus Pierce 1930: 7.
sparsus (Pierce) 1930: 9.
submetallicus (Schaeffer) 1904: 224.
walshi (Leconte) 1876: 400.

Araeoderes Schaeffer 1906: 275.
texanus Schaeffer 1906: 276.

Tribe Platystomini

Phoenicobiella Cockerell 1906: 243.
Phoenicobius Leconte 1876: 400, *nec* Moerch 1852: 32.
chamaeropis (Leconte) 1876: 401.
schwarzi (Schaeffer) 1906: 273.

Toxonotus Lacordaire 1866: 575.
Anthribus Leconte 1876: 402, *nec* Forster 1771: vii, 9.
Neanthribus Jordan 1906: 341.
Neanthribius Leng & Mutchler 1914: 481.
Pseudanthribus Pierce 1930: 24.
bipunctatus (Schaeffer) 1904: 235.
cornutus (Say) 1831: 4.
coronatus (Gyllenhal) 1833: 141.
fascicularis (Schoenherr) 1833: 132.
lividus (Leconte) 1876: 403.
penicellatus (Schaeffer) 1904: 236.

Tribe Piesocorynini

Brevibarra Jordan 1906: 312.
Tropideres Leconte 1876: 395, in part, *nec* Schoenherr 1823: 1135.
rectus (Leconte) 1876: 395.

Piesocorynus Dejean 1833: 235.
Piezocorynus Schoenherr 1839: 250.
Camptotropis Jekel 1855: 136.
mixtus Leconte 1876: 402.
moestus (J. E. Leconte) 1824: 172.
capillicornis (Say) 1827: 249.
plagifer Jordan 1904: 277.
dispar Leconte 1876: 402, *nec* Gyllenhal 1833: 140.

tesselatus Schaeffer 1906: 274.
virginicus Leng 1918: 11.

Tribe Tropiderini

Tropideres Schoenherr 1823: 1135.
Tropidoderes Gemminger & Harold 1872: 2733.
Gonotropis Leconte 1876: 393.
Eurymycter Leconte 1876: 394.
dorsalis (Thunberg) 1796: 146.
gibbosus (Leconte) 1876: 394.
fasciatus (Olivier) 1795 genus 80, no. 9.
bicarinatus (Pierce) 1930: 17.
latifascia (Pierce) 1930: 17.
tricarinatus (Pierce) 1930: 18.

Tribe Platyrhinini

Goniocloeus Jordan 1904: 260.
Straboscopus Lacordaire 1866: 533, in part.
Tropideres Leconte 1876: 395, in part, *nec* Schoenherr 1823: 1135.
bimaculatus (Olivier) 1795 genus 80, no. 19.
quadrinotatus (Say) 1827: 249.
barberi (Pierce) 1930: 13.

Trachytropis Jordan 1904: 266.
arizonicus (Sleeper) 1954: 117.

Tribe Gymnognathini

Gymnognathus Schoenherr 1826: 4, 37.
Analotes Schoenherr 1839: 198.
chiricahuae Sleeper 1954: 118.

Tribe Allandrini

Stenocerus Schoenherr 1826: 4, 39.
longulus ssp. *mexicanus* Jekel 1855: 109.
variegatus Motschoulsky 1874: 234.
knullorum Sleeper 1953: 114.

Allandrus Leconte 1876: 396.
bifasciatus Leconte 1876: 396.
brevicornis Frost 1920: 252.
populi Pierce 1930: 19.

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RESULTS OF THE CATHERWOOD PERUVIAN-AMAZON EXPEDITION

NEW SPECIES OF SOUTH AMERICAN TENDIPEDIDAE (DIPTERA)

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With the exception of the species of *Aedokritus*, all the material described in this paper was taken by the author in the course of the Catherwood Peruvian-Amazon Expedition (September-October, 1955). The male and female of the new *Aedokritus* species were graciously loaned by Dr. Paul Freeman of the British Museum (Natural History). Except for this pair, all the material is preserved in alcohol or on slides.

In all, 14 species are described here, 12 of these being, to the best of my knowledge, new. The disposition of the specimens is indicated at the end of each species description.

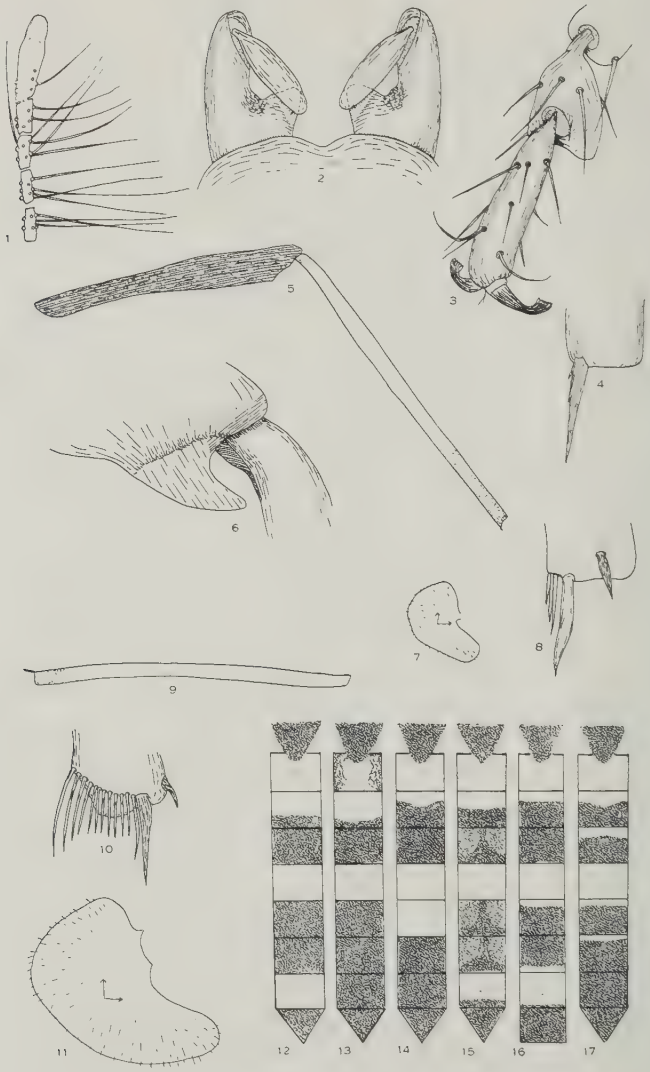
Subfamily Hydrobaeninae

Genus **CARDIOCLADIUS** Kieffer

Cardiocladius travassosi Oliveira

1951 Pap. Avuls. Dept. Zool. São Paulo 10: 133–138.

Two males before me agree in all respects, except the form of the inner lobe of the basistyle, with the description of the above species given by Oliveira (1951). Since the pressure used in mounting and the orientation of the aedeagus can materially affect the shape of the inner lobe, I do not consider the difference here sufficient for the erection of a new species. The antennal ratio of one of my specimens is .30 or .21. The apical antennal segment is partially separated into two segments (fig. 1) and the flagellum can be considered to have 12 or 13 segments resulting in different antennal ratios. The genitalia of this specimen is shown in fig. 2.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Material examined:

2 ♂; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [In collection of Academy of Natural Sciences of Philadelphia.]

Genus **CRICOTOPUS** Van der Wulp

Cricotopus nalus new species

This species is closely related to the North American *Cricotopus absurdus* (Joh.) described from a single female. It differs from *C. absurdus* in its smaller size and in having only five setae on the genital claspers. The male here associated with it, while not taken in copula, was the only dark *Cricotopus* male taken and agrees with the female in general characteristics.

FEMALE.—1.6 mm. long; head brown; antenna and antennal pedicel brown; ratio of antennal segments 25 : 17 : 17 : 19 : 50; eyes densely haired; thorax light yellow-brown; mesonotum with three red-brown vittae; scutellum light yellow-brown; postnotum red-brown; mesonotal hairs small and fine (.014 mm. long); wing (fig. 20) 1.3 mm. long; veins brown; C produced; R_{2-3} reaches C .6 from R_1 to R_{4+5}; M ends near wing tip; R_{4+5} and Cu_1 equidistant from wing tip; squamae haired; halteres light brown; legs brown; foreleg ratio .65; foretibia with simple light spur (.03 mm.); mesotibia with two unequal spurs (.025 and .015 mm.); metatibia with a long light spur (fig. 23) (.16 mm.) and a comb of six or seven small spines; empodium well developed (fig. 24), no pulvilli; ratios of leg parts in table 1; abdomen yellowish brown with light blackish brown infuscation, last two segments darker; sternites yellow except for last which is brown; claspers (figs. 19, 19A) brown; .18 mm. long with five apical setae; spermathecae (2) .13 mm. × .05 mm., light brown (fig. 18).

Figs. 1–4. *Cardiocladius travassosi* Oliveira. Fig. 1, apex of male antenna; fig. 2, male genitalia, dorsal; fig. 3, apex of mesothoracic tarsi; fig. 4, foretibial spur.

Figs. 5–8. *Cricotopus setis* Roback. Fig. 5, forefemur and tibia; fig. 6, preapical spur of mesofemora; fig. 7, female genital clasper; fig. 8, spurs and comb, female metatibia.

Figs. 9–11. *Cricotopus zuelis* Roback. Fig. 9, foretibia; fig. 10, spurs and comb, female metatibia; fig. 11, female genital clasper.

Figs. 12–17.—Abdominal maculation, diagrammatic. Fig. 12, *Cricotopus eleanatis* Roback ♀; fig. 13, *Cricotopus rubrum* Roback ♀; fig. 14, *Cricotopus zuelis* Roback ♀; fig. 15, *Cricotopus cantus* Roback ♀; fig. 16, *Cricotopus cantus* Roback ♂; fig. 17, *Cricotopus setis* Roback ♀.

Male.—2.0 mm.; head and antennae brown; antennal ratio .86; palpus four-segmented, brown; thorax light brown; three red-brown vittae; sternum dark brown; wing 1.8 mm. long; leg ratio .69; legs brown; forelegs slightly darker; metatibia with spur (fig. 21) (.05 mm.) and comb of six to seven small setae; spurs of foretibia and mesotibia like female; abdomen and genitalia (fig. 22) black-brown.

	FEMALE							MALE						
	F	Tib	T_1	T_2	T_3	T_4	T_5	F	Tib	T_1	T_2	T_3	T_4	T_5
I	37	49	32	17	11	8	7	37	52	36	20	15	..	..
II	38	41	22	9	7	5	5	37	40	20	10	9	6	6
III	35	39	31	14	11	5	5	37	42	26	12	11	5	5

Table 1. Ratios of leg segments of *C. nalus*.

Holotype.—♀; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [In collection of Academy of Natural Sciences of Philadelphia, Type No. 6820 (on slide).]

Allotype.—♂; same data as ♀, (on slide).

Paratypes.—2 ♂, 1 ♀ (slides); 4 ♂, 4 ♀ (alc.).

Females vary in length from 1.3–1.8 mm.; abdomen appears yellower in gravid specimens.

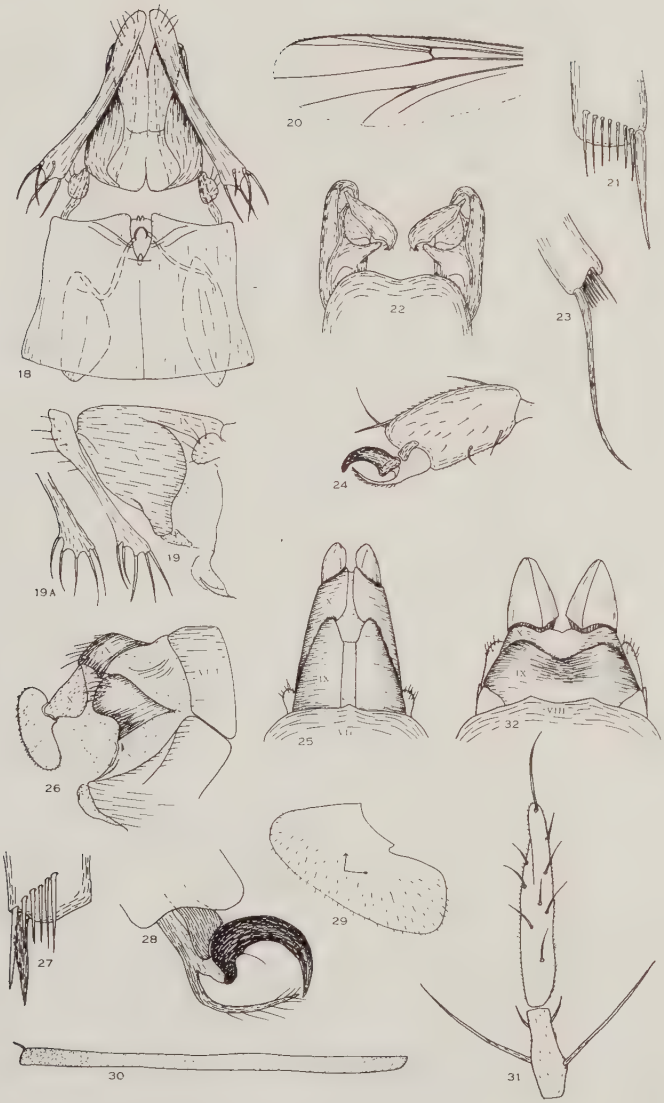
The unusually shaped apex of the female abdomen of *C. nalus* (figs. 18, 19, 25) appears to be formed by the highly modified ninth and tenth segments, those of *C. nalus* being a more specialized version of the usual cerci found in this and other genera (fig. 26). The male tentatively associated with the above female is a typical *Cricotopus*.

The following five species all have yellow-black or brown banded abdominal tergites. The ratios of the leg segments of the females are given in table 2.

Figs. 18–25. *Cricotopus nalus* Roback. Fig. 18, apex of female abdomen, ventral; fig. 19, apex of female abdomen, lateral; fig. 19 A, detail of flattened apex of female genital clasper; fig. 20, wing; fig. 21, metatibial spur and comb, male; fig. 22, male genitalia, dorsal; fig. 23, metatibial spur, female; fig. 24, detail of last mesotarsal segment and claw; fig. 25, apex of female abdomen, dorsal.

Figs. 26–31. *Cricotopus eleanatis* Roback. Fig. 26, apex of female abdomen, lateral; fig. 27, metatibial spur and comb, female; fig. 28, detail of claw; fig. 29, female genital clasper; fig. 30, foretibia; fig. 31, apex of female antenna.

Fig. 32.—*Cricotopus rubrum* Roback; apex of female abdomen, dorsal.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IX
VIII

Cricotopus cantus new species

This may be the species described by Kieffer (1925) as *Trichocladius ornaticrus*. As Freeman (1956) mentions, four of the six *Trichocladius* species described from Africa by Kieffer were *Cricotopus* and Kieffer apparently confused the genera. There are some minor points of difference between the two—the specimens before me do not have any dark bands on abdominal segment 1 and Kieffer does not mention the extent of the band on segments 2 and 5. Without the type, I would hesitate to arbitrarily place my specimens in Kieffer's species. The thoracic hairs of the *Cricotopus* species described in this paper ranged from .014–.025 mm. in length. Those of *T. senex* Joh. were .083 mm. long.

Female.—Length 2.0 mm.; head dark red-brown; antennae brown; ratio of flagellar segments 24 : 18 : 18 : 20 : 42; palpus light brown; ratio of segments 8 : 15 : 20 : 35; mesonotum yellow with three red-brown vittae; vittae very distinct; mesonotal hairs small (.025 mm.); pleurae, sternum and scutellum light red-brown; postnotum dark red-brown; wing 1.8 mm. long; veins brown; costa produced; R_{4+5} and Cu_1 equidistant from wing tip; M ends near wing tip; f Cu slightly past r-m; squamae haired; halteres light; leg ratio .65; foretibia banded as in fig. 33; with single apical spur; mesotibia similarly banded, band smaller and not as distinct; with two unequal apical spurs; metatibia uniform brown; with apical spur (fig. 37) and comb; femora brown, slightly darker at apex; forefemur darker than others; meso- and metafemora with preapical projections; tarsi brown; no pulvilli, abdomen marked as in fig. 15; lighter areas on tergites 5 and 6 with bluish cast; sternites yellow, 4–7 darkened caudo-laterally, 8 brown; genital claspers (fig. 34) light, spermathecae (fig. 36) (2) brown, .07 mm. long, flask shaped.

Male.—2.2 mm. long; antennae and fortarsal segments missing; coloration of head and thorax as in female; wing 1.8 mm. long; foretibia banded as in female, white band slightly wider; legs otherwise like female; abdomen marked as in fig. 16; genitalia (fig. 38) white.

Holotype.—♀; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6821.]

Allotype.—♂; on slide, same data as Holotype.

Paratypes.—1 ♀ (alcohol). 2 ♀ (on slides); same data as holotype.

	I	II	III
cantus	70:92:66:— — — –	65:70:35:15:11:5:5	60:78:42:— — – –
setis	60:70:48:20:17:11:7	55:54:28:12:10:6:6	50:55:35:16:14:7:7
zuelis	50:60:— — — — –	48:45:21:9:7:4:4	45:50:27:13:11:5:5
elaneatis	55:65:40:18:15:11:7	50:50:22:11:8:5:5	50:55:30:15:12:7:7
rubrum	— — — — — — –	— — — — – – –	60:75:42:19:14:9:7

Table 2. Ratios of segments of legs of female *Cricotopus* species, femur, tibia, tarsus (banded forms).

Cricotopus setis new species

This species differs from the closely related *C. algicola* (Kieffer) in lacking pulvilli and in its larger leg ratio. It can be separated from *C. bicinctus* (Meigen) and *C. bimaculatus* Tokunaga by the yellow mesonotum with distinct red-brown vittae.

Female.—Length 1.7 mm.; head and antennal pedicel red-brown; antenna brown; flagellar segments in ratio 25 : 18 : 18 : 18 : 41; mesonotum, pleurae and sternum like *C. cantus;* scutellum and postnotum dark red-brown; wing 1.6 mm. long; costa produced; R_{4+5} and Cu_1 equidistant from wing tip; M ends slightly below wing tip; squamae haired; halteres yellowish; leg ratio .69; all femora dark brown; slightly expanded apically; meso- and metafemora with preapical projections (fig. 6); foretibia with white area as in fig. 5; mesotibia similar, with white area smaller and not as distinct; metatibia brown, slightly darker basally; metatibial spurs as in fig. 8; tarsi light brown except two basal foretarsal segments, these dark brown; coxae red-brown; trochanters light, pulvilli absent, abdomen marked as in fig. 17; sternites yellow with some blackish infuscations; this especially pronounced on apical segments; female claspers (fig. 7) light; spermathecae light brown; .098 mm. long.

Holotype.—♀; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6822 (on slide).]

Cricotopus zuelis new species

This species differs from the preceding in abdominal maculation. It can be separated from *C. bifascia* Tokunaga by the yellow base of abdominal segment 2 and the sinuous medial vein. It is very close to *C. triannulatus* (Macq.) but can be separated by the fact that the last antennal segment of the female is only twice as long as the preceding, rather than three times as long as in *C. triannulatus.*

FEMALE.—Length 1.8 mm.; head and thoracic color and maculation as in *C. cantus;* scutellum and postnotum dark red-brown; antennal flagellar segments in ratio 25 : 17 : 20 : 20 : 43; wing 1.4 mm. long; veins brown; M sinuous, ends in wing tip; Cu_1 and R_{4+5} equidistant from wing tip; costa produced; f Cu just past r-m; R_{4+5} and R_1 almost parallel; R_{2+3} difficult to discern; squamae fringed, halteres light; foretarsi missing; foretibia almost completely light (fig. 9); mesotibia similar; forefemur dark brown; meso-metafemora lighter brown; metatibia brown; meso- and metatarsal segments light brown; coxae red-brown; trochanters lighter; meso- and metafemora with preapical projections; pulvilli absent; abdominal maculation as in fig. 14; sternites yellow; apical sternites darker; spermathecae brown; female claspers (fig. 11) light.

Holotype.— ♀ ; Hotel Tourista, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll S. S. Roback, (at light). [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6823. (on slide).]

Cricotopus eleanatis new species

A very distinctive species with markings similar to *C. trifasciatus* (Panz.) but the foretibia are not white ringed.

FEMALE.—Length 1.8 mm.; head and antennal pedicel red-brown; antenna (fig. 31) brown; segments in ratio 25 : 18 : 18 : 40; four large bristles caudo-mesad of inner corner of eye, on either side of vertex; palpus light brown, four segmented; mesonotum yellow with three red-brown vittae; pleurae yellowish; sternum yellow-brown; scutellum yellow-brown; postnotum yellow-brown at base, darker red-brown apically; wing 1.5 mm.; venation similar to *C. setis;* squamae haired; halteres yellowish; leg ratio .62; coxae red-brown; trochanters light; femora light brown, darker in apical third, meso- and metafemora with preapical projections; foretibia very light brown, darkened in apical fifth (fig. 30) and slightly at base, meso- and metatibiae light brown; metatibial spur and comb (fig. 27); basal three foretarsal segments brown; apical two light brown; meso- and metatarsi light brown; pulvilli lacking; empodium well developed (fig. 28); abdomen

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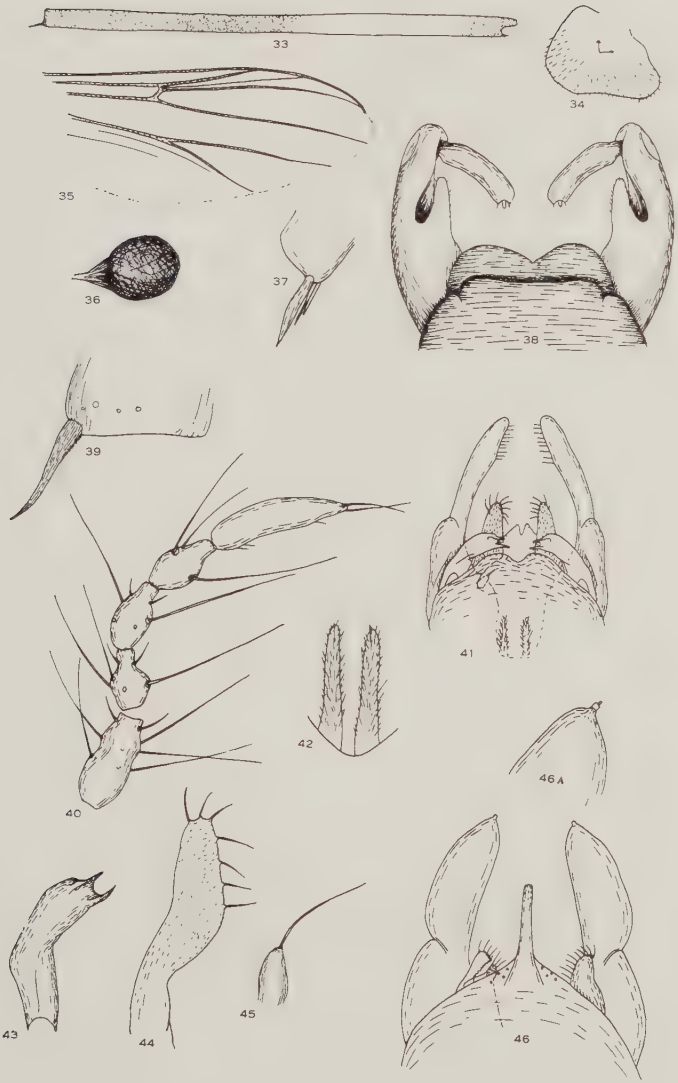
Figs. 33–38. *Cricotopus cantus* Roback. Fig. 33, foretibia, female; fig. 34, female genital clasper; fig. 35, wing; fig. 36, spermatheca; fig. 37, metatibial spur and part of comb; fig. 38, male genitalia, dorsal.

Figs. 39–45. *Pseudochironomus viridis* (Kieffer). Fig. 39, foretibial spur; fig. 40, female antenna; fig. 41, male genitalia, dorsal; fig. 42, ventral appendages; fig. 43, superior appendage (1); fig. 44, inferior appendage (2); fig. 45, accessory appendage (2a).

Figs. 46 and 46A. *Cryptochironomus astax* Roback. Fig. 46, male genitalia, dorsal; fig. 46A, detail of apex of distyle.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marked as in fig. 12; yellow areas with slight greenish infuscation; sternites yellowish except last which is brown, spermathecae light brown; .01 mm. long; genital claspers off-white in color (fig. 29).

Holotype.— ♀ ; Hotel Tourista, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6824 (on slide).]

Paratype.—1 ♀ (on slide); same data as holotype.

Cricotopus rubrum new species

The combination of the all white foretibia and the brown banded metatibia will separate this species from any *Cricotopus* species known to me.

Female.—Length 1.9 mm.; head and antennal pedicel red-brown; antenna brown; segments in ratio 24 : 16 : 15 : 16 : 40; palpi brown, four segmented; pronotum dark red-brown; mesonotum shining red-brown; vittae darker red-brown, not too distinct, pleurae red-brown, sternum shining red-brown; scutellum and postnotum brown, not shining; wing 1.5 mm.; veins brown; venation similar to fig. 20; squamae appear partly fringed; halteres brown at apex; leg ratio .64; coxae red brown; trochanters lighter brown; femora dark brown; foretibia all white; mesotibia white with some infuscation at each end; metatibia white with middle third brown; foretarsi dark brown; meso- and metatarsi light brown; empodium well developed, no pulvilli; abdominal maculation as in fig. 13; sternites dark brown; claspers white.

Holotype.— ♀ ; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1959; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6825.]

Subfamily Tendipedinae

Genus **CRYPTOCHIRONOMUS** Kieffer

The only species previously described from South America in this genus were *C. supparilis* (Edwards) and *C. forcipes* Rempel. From Edwards description his species would fall in *Harnischia* as used by Townes (1945). Rempel (1939) places his in the " Gruppe *Harnischia* ". Freeman (1957) has replaced *Cryptochironomus* and other genera separated by Townes (1945) as subgenera of *Chironomus*. I cannot agree with this concept. The presence of intergrades, mentioned by Freeman, does not

necessarily invalidate the genera concerned. Nature does not pigeonhole discreet little generic packages as we would like to have them. While it would be very convenient to have genera which can be recognized infallibly in both sexes, I cannot see that it is essential—in fact the only way this can be achieved, in most cases, is by the use of large, unwieldy catchall genera.

Freeman's placement of *Harnischia* within *Cryptochironomus* is, I feel, correct. As I pointed out (Roback 1957), the immature stages indicate that the two genera are closely related and this would support the combination of the two genera based on the adult characteristics. The immatures also seem to indicate that the species formerly placed in *Harnischia* should be given at least species group or possibly subgeneric status.

The following species seems to be the first species of *Cryptochironomus* s. str. from South America. It appears closely related to *C. fulvus* (Joh.) but differs in its lower antennal ratio (3.0 for *C. fulvus*) and in details of the aedeagus. Appendage 1 of *C. fulvus* has a few apical hairs, while that of the species below has a row of hairs along the mesal margin (fig. 46).

Cryptochironomus astax new species

Male.—3.6 mm.; head brown; antennal pedicel brown; antennal ratio 2.2: flagellum brown with 11 segments; basal segments wider than long with two irregular verticels each; palpus four segmented; segment 3 shorter than segment 2 or 4 which appear subequal; very small frontal tubercles present; pronotum collar-like; a small central emargination; mesonotum and pleura light yellow-brown; lightly pollinose vittae darker red-brown, distinct; sternum shining red-brown; scutellum light; postnotum dark red-brown, wing 2.4 mm.; R_{2+3} distinct from R_1 at apex; ends of M and R_{4+5} about equidistant from apex of wing; f Cu barely past r-m; R_{4+5} past Cu_1; r-m not darkened; halteres light, infuscated apically; squamae haired; legs light brown; a preapical dark band on femora and a subbasal band on tibia; tarsal segments missing; combs of meso- and metatibia appear fused with two short but stout spurs each; abdomen brown; genitalia as in figs. 46 and 46A; apex of distyle with a small tubercle which apparently bears a stout hair (broken in specimen).

Holotype.—♂; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6826.]

Genus **PSEUDOCHIRONOMUS** Malloch

This genus is widely distributed in the new world with ten species listed by Townes (1945) for North America and five species described by Edwards (1931) and Kieffer (1925) from South America. In contrast Goetghebuer (1937) lists only three species from Europe and Freeman (1957) states that this is a non-African genus.

Pseudochironomus viridis (Kieffer)

1925. Ann. Soc. Scient. Bruxelles 44: 79–81 [*Proriethia viridis*].

This species was described by Kieffer from Alta Gracia, Cordoba province, Argentina. The male which I have before me is not readily separable from Kieffer's description of the above species except in its slightly larger leg ratio. It agrees with his description on the black-brown anterior tibiae and tarsi, the more gradually darkened posterior tarsi, and the green abdomen. Kieffer's description of the superior appendages as " dirigés l'un vers l'autre, leur extrémité échancrée et brièvement bilobée " and the ventral appendages as " linéares, pubescents et parallèles " fits the specimen I have. For these reasons, I am assigning my male to his species.

Male.—Length 3.1 mm.; head and antennal pedicel light brown; antennal ratio about 2.0 (tip of antenna broken); palpi four segmented, light brown; eyes typical for genus; pronotum with median interruption; mesonotum light with three brown vittae; lateral vittae extend on to postalar callus; mesonotal hairs uniserial; pleurae and sternum light brown, shining; scutellum and postnotum light brown; postnotum darker along outer margin; foreleg ratio 1.25; femur, tibia and first tarsal segment in ratio 87 : 96 : 121; foretarsi not banded; forefemur light brown, tibia and tarsi dark brown; foretibial spur (fig. 39) black, basally constricted, .06 mm. long; meso- and metatarsi medium brown; slightly darker apically; combs of meso- and metatibiae separate, subtriangular, each with a long spur; wings 2.0 mm.; R_{2+3} close to R_1 at costa; R_{4+5} exceeds Cu_1; f-Cu past r-m; M slightly closer to wing tip than R_{4+5}; halteres light; squamae haired; abdomen green with light brown hairs; tergites 8 and 9 with some brown; anal point lacking (fig. 41); ninth tergite apically emarginate; superior appendages (fig. 43) curved toward each other; apically concave; inferior appendages (fig. 44); foot shaped with a small nipple-like projection (fig. 45); .012 mm. long at its base; (appendage 2a) this projection bears an apical hair twice as long as tubercle; ventral appendages (fig. 42) from bases of basistyle, .098 mm. long, parallel, hairy.

Female.—2.1 mm. long; head, thorax and legs like male; foreleg ratio 1.26; antennae (fig. 40); brown; flagellum five segmented; segments in ratio 20 : 12 : 13 : 13 : 28; basal segment constricted; abdomen light brown with greenish tinge; genital claspers light brown.

Material examined:

1 ♂, 1 ♀; Hotel Tourista, one mile east of Tingo Maria, Peru; October 6, 1955; coll. S. S. Roback, at light. [In collection of the Academy of Natural Sciences of Philadelphia.]

Genus **AEDOKRITUS** Roback

The genus *Aedokritus* was described by the author in 1958 from specimens collected at light from Iquitos, Peru. Since then, an examination of the descriptions of three species described by Edwards from Argentina in the appendix to Edwards (1931) convinced me that they belonged in the above genus and that the type of *Aedokritus*, *A. vardis* Roback was probably a synonym of *C. penicilligerus* Edw. Dr. Paul Freeman has very graciously examined Edwards' types for me and has confirmed both the above statements. I therefore place *A. vardis* as a synonym of *C. penicilligerus* Edw. which now becomes the type species of *Aedokritus*.

Dr. Freeman has loaned me specimens of a new species of this genus. This species is described below.

The following key will separate the now known species of the genus.

Key to Species

1. Wings with a single blackish spot below base of Cu_2 and a faint cloud on and below r-m (Argentina) ..... *A. pruinescens* (Edw.)
   Wings with one or two blackish crossbands 2
2. Wings with two dark crossbands; basal crossband forked toward hind margin; genital appendage 2a slender with a few long hairs at tip (Argentina) ..... *A. platycnemis* (Edw.)
   Wings with only a single dark crossband 3
3. Wings with a single fairly even crossband extending from base of R_1 to hind wing margin; genital appendage 2a clavate with a dense apical brush of long hairs (Argentina, Peru) ..... *A. penicilligerus* (Edw.)
   Wings with crossband from base of R_1 to hind wing margin, very broad behind Cu_2 (fig. 19); apex of wing slightly cloudy; genital appendage 2a narrow, slightly sinuate, with moderately dense apical brush of long hairs (fig. 74) (Brazil) ..... *A. sartis* n. sp.

Aedokritus sartis new species

On the basis of the narrow appendage 2a of the male aedeagus, this species appears to be closely related to *A. platycnemis* (Edw.). It can be separated by having only a single dark cross-band on the wings.

MALE.—5.2 mm. long; head black-brown; eyes closer above than below; antennal pedicel black-brown; antenna light brown; antennal ratio about 3; maxillary palpus four segmented, light brown; pronotum brown, pollinose; anteriorly incised but not completely divided; mesonotum brown overlain with gray-green pollen; vittae indistinct; pleurae and sternum brown with dense gray-green pollen; wings 3.48 mm. long; marked as in fig. 69; squamae haired; leg ratio .86; coxae, trochanters, femora and tibiae dark brown; tarsal segments, especially first tarsal segment, lighter; halteres light brown; scutellum subshining black-brown; postnotum black-brown, lightly pollinose; abdomen dark brown; tergites with more black coloration from tergite 4 on; anterior one-quarter of tergites pollinose; genitalia (figs. 70 and 71) black-brown; details of genital appendages 1, 2, 2a (figs. 72–74).

FEMALE.—4.8 mm.; antennal flagellum six segmented; segments 1–5 light brown, segment 6 darker; segment 1 mesally constricted; color of head as in male; eyes slightly more widely separated than in male; color and pollinosity of thorax as in male; wing markings even more distinct than in male; leg ratio .81; abdomen generally as in male; tergites 5–7 with some lateral brown areas; genital claspers brown.

Holotype.— ♂ ; Messias Carrera, 1936, São Paulo, Brazil. [In collection of British Museum (Natural History).]

Allotype.— ♀ ; same data as holotype.

Genus **NILOTHAUMA** Kieffer

Freeman (1957) has pointed out that the species formerly placed in *Kribioxenus* by Townes (1945), Edwards (1929), and Goetghebuer (1937) properly belong in the genus *Nilothauma* Kieffer. The following two new species from Peru fit the concept of the aforementioned genus very closely except that they lack any dorsal projections of the ninth tergite of the male. Inasmuch as two of the included species in the genus (*N. brayi* and *N. babiyi*) have one projection and the other three (*N. mirabilis*, *N. bicornis*, and *N. pictipenne*) have two projections each, it seems more reasonable to emend the generic description to read "none to two projections on the ninth tergite" and include the following species within the genus.

Nilothauma aleta new species

The aedeagal parts and the lack of dorsal projections on the ninth tergite will separate this and the following species from any of the aforementioned *Nilothauma* species.

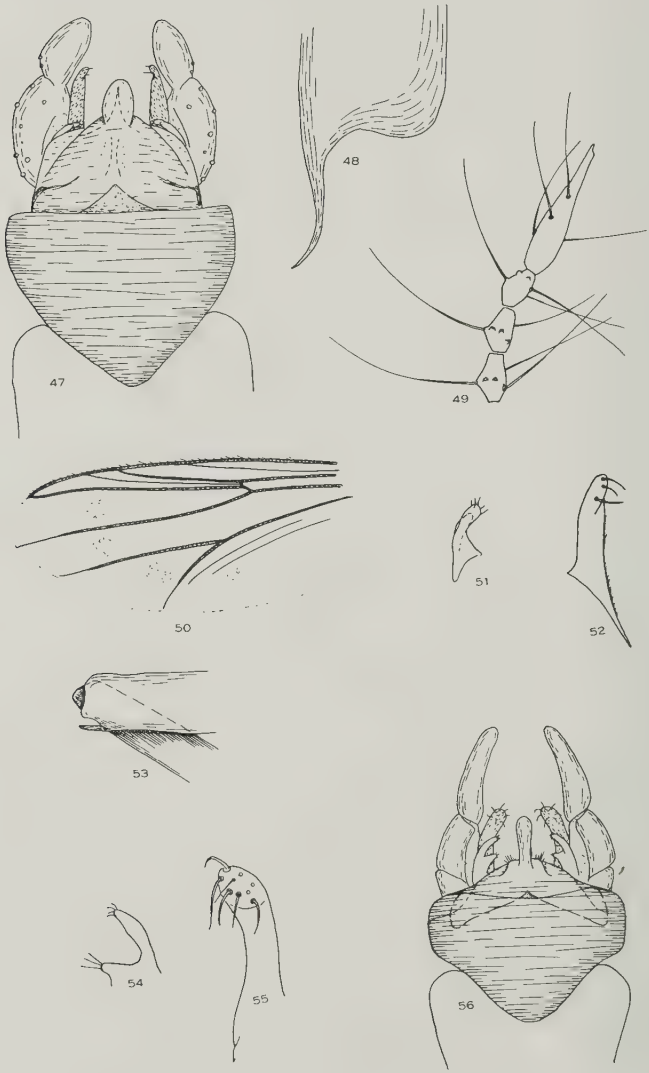
MALE.—Length 2.4 mm.; head light reddish brown; eyes approximated, above and below; antennal ratio .28; last four segments (fig. 49) in ratio 9 : 9 : 9 : 29; antennal flagellum brown; frontal tubercles absent; pronotum reduced, completely surpassed by mesonotum; mesonotum light brown with three red-brown vittae; low angular projection at antero-lateral corners of median vitta; pleurae light brown, sternum darker brown; scutellum light yellow-brown; postnotum brown, mesonotum and pleurae slightly pruinose; mesonotal hairs uniserial; wing 1.8 mm.; with light marks as in fig. 50; R_{2+3} separate from R_1; M closer to wing tip than R_{4+5}; cubital fork wide; f-Cu well past r-m; squamae bare; halteres light; foreleg ratio 1.3; foreleg light brown; apex of tibia, base and apex of first tarsal segment and second and third tarsal segments darker; forefemur slightly sinuate; meso- and metathoracic legs light; femora with a brown crossband one-third from apex; apices of tibiae and tarsi darkened; foretibial spur elongate (fig. 48); combs of mesotibia slightly separated with one small spur on outer comb, inner comb bare; combs of metatibia with one short spur on each, these spurs difficult to discern; combs occupy two-thirds to three-quarters of circumference of apex of tibiae, teeth short and poorly formed; meso- and metafemora with preapical projections, similar to figs. 6 and 53; pulvilli absent, small empodium present; abdomen light yellow-brown; male genitalia as in fig. 47, appendage 1 apparently bifid (fig. 51); appendage 2 as in fig. 52; no dorso-mesal projections on ninth tergite.

Holotype.—♂; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6827.]

Nilothauma duena new species

The form of the aedeagus and its parts and the maculation of the abdomen will separate this species from *N. aleta.*

MALE.—Length 2.4 mm.; head light brown; antennal pedicel light brown; antennae missing; palpus light; segments in ratio 5 : 15 : 19 : 30; frontal tubercles absent; pronotum reduced, hidden by mesonotum; mesonotum yellow-brown with red-brown vittae; vittae not too distinct, mesonotum and pleurae pollinose; projection at antero-lateral corners of median vitta not as distinct as in *N. aleta;* pleurae light brown with a horizontal darker brown band; mesosternum shining brown; scutellum light yellow-brown; postnotum brown; wing 1.8 mm. long, unmarked; venation as in fig. 50;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halteres light; foretarsi missing; forefemur and tibia brown with median third of each yellow; meso- and metathoracic legs yellowish with apices of femora, bases and apices of tibiae, and apices of tarsal segments darkened; foretibial spur as in fig. 48; combs and spurs of meso- and metatibiae as in *N. aleta*, spurs slightly better developed; pulvilli absent; small empodium present; meso- and metafemora with preapical projections (figs. 6 and 53); abdomen yellow; tergite 1 with a lateral pair of brown lines; basal one-third of tergites 2–6 brown; most of tergite 7 and all of 8 and 9 brown; sternites 7 and 8 brown; basistyle brown; distyle yellow; male genitalia as in fig. 56; appendage 1 (fig. 54) bifid; appendage 2 as in fig. 55; no dorso-mesal projections on ninth tergite.

Holotype.— ♂ ; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6828.]

Paratype.— ♂ ; on slide; same data as above.

Genus **CALOPSECTRA** Kieffer

Group *Rheotanytarsus*

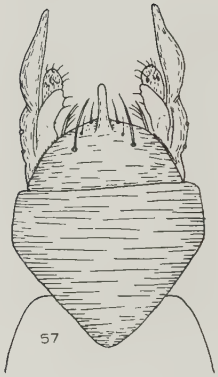
One species of this group was described by Kieffer (1925) from Argentina. The general description of this species (*Rheotanytarsus abreviatus*) could fit either of the following new species, however the antennal ratio of .385 (5:13) is far higher than those found in the Peruvian species.

Calopsectra breda new species

Male.—Length 1.4 mm.; head, antennal pedicel yellow-brown; antennae yellow-brown; antennal ratio .22; basal flagellar segments about twice as long as wide with two irregular verticels each; cephalic tubercles lacking, thorax yellow-brown; three indistinct red-brown vittae; scutellum and postnotum light; legs yellow; leg ratio 2.95 (from 1.0 mm. paratype); metatibial spurs as in fig. 59; pulvilli absent; wing (fig. 58) 1.2 mm. long; R_{4+5} barely past Cu; R_{2+3} not discernible; squamae bare; halteres light; abdomen yellow with greenish tinge; genitalia as in fig. 57; appendages as in figs. 60–62; appendage 1a not discernible; 2a with long apical hairs (fig. 62).

Figs. 47–52. *Nilothauma aleta* Roback. Fig. 47, male genitalia, dorsal; fig. 48, foretibial spur; fig. 49, apex of male antenna; fig. 50, wing; fig. 51, superior appendage (1); fig. 52, inferior appendage (2).

Figs. 53–56. *Nilothauma duena* Roback. Fig. 53, preapical femoral spur, dorsal view; fig. 54, superior appendage (1); fig. 55, inferior appendage (2); fig. 56, male genitalia, dorsal.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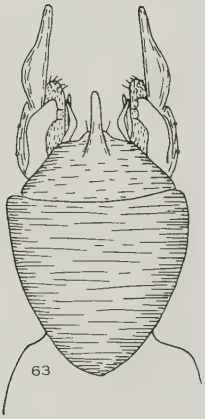
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VARIATION.—Length 1.0 mm. to 1.5 mm.; antennal ratio .22–.28.

Holotype.—♂; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light. [Type in collection of Academy of Natural Sciences of Philadelphia, Type No. 6829 (on slide).]

Paratypes.—1 ♂ in alcohol; 3 ♂ on slides; same data as holotype.

Calopsectra pela new species

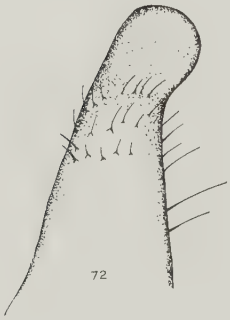
MALE.—Length 1.5 mm.; color of head and antennae as in *C. breda;* antennal ratio about .2 (tip broken); leg ratio 3.15 (paratype); forefemora expanded apically, legs yellow; pulvilli absent; segments of foreleg (paratype) starting with femur 60 : 30 : 94 : 40 : 30 : 23 : 10; mesothoracic leg (holotype) 65 : 50 : 25 : 14 : 10 : 6 : 5; metathoracic leg (holotype) 74 : 60 : 33 : 23 : 20 : 14 : 6; wing 1.3 mm.; wing venation, squamae, halteres as in *C. breda,* abdomen as in *C. breda;* genitalia (fig. 63); appendage 2a with a pair of apical lamellae and some hairs on shaft (figs. 64 and 65); appendages 1 and 2 (figs. 66–68).

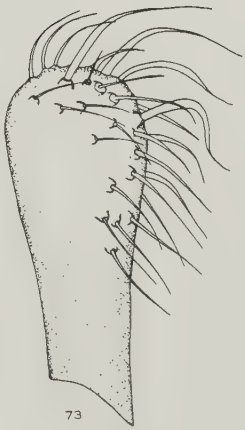
Holotype.—♂; Hotel Tourista, overlooking Huallaga River, one mile west of Tingo Maria, Peru; September 24–27, 1955; coll. S. S. Roback, at light (on slide). [In collection of Academy of Natural Sciences of Philadelphia, Type No. 6830.]

Paratype.—♂; same data as holotype (in alcohol).

Figs. 57–62. *Calopsectra breda* Roback. Fig. 57, male genitalia, dorsal; fig. 58, wing; fig. 59, metatibial combs and spurs; fig. 60, superior appendage (1); fig. 61, inferior appendage (2); fig. 62, accessory appendage (2a).

Figs. 63–68. *Calopsectra pela* Roback. Fig. 63, male genitalia, dorsal; fig. 64, accessory appendage (2a), flattened; fig. 65, accessory appendage (2a), dorsal; figs. 66 and 67, inferior appendage (2); fig. 68, superior appendage (1).





Figs. 69–74. *Aedokritus sartis* Roback. Fig. 69, wing; fig. 70, male genitalia, left half, dorsal; fig. 71, male genitalia, lateral view; fig. 72, superior appendage (1); fig. 73, inferior appendage (2); fig. 74, accessory appendage (2a).

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A MONOGRAPH OF THE ITHOMIIDAE (LEPIDOPTERA)

PART II

THE TRIBE MELINAEINI CLARK

BY RICHARD M. FOX

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Tribe Melinaeini Clark

Melinaeini Clark, 1948, p. 80. Fox, 1956, p. 22.

The tribe Melinaeini, containing the single genus *Melinaea*, was defined in part I (1956) of this monograph as having the male foreleg with the femur and tibia both shorter than the coxa, the tarsus inarticulate and fused on the tibia, five fore tarsal joints in the female and in the male genitalia large ovoid armed *appendices angulares*. The genus is easily recognized, however, by the venation. For practical purposes it is not necessary to study microscopic features. The hind wing cell has a characteristic shape with 2d forming nearly a right angle, both arms of which are about the same length; a rather long Mr arises from this angle and reaches back well into the discal cell; Sc always is free from the base on out and never is fused with R in either sex. The hair patch of the males is divided so that the proximal patch is small and pencil-like, the distal patch much the larger.

Attention should be drawn to the very close similarity between some of the species in *Melinaea* and species belonging in other genera. Unless the venation is verified it is easy to confuse *Melinaea* with *Mechanitis* or with *Heliconius*. As a rule, similar species in *Hypothyris, Hyposcada,* and *Oleria* are enough smaller than *Melinaea* that less difficulty is encountered. This mimetic phenomenon has been discussed at length in a number of studies, among which should be mentioned Haase (1893), Kaye (1907), Moulton (1909) and Punnett (1915) as pertinent to *Melinaea*. The last word has not been written on mimicry, I am sure. The theories of Batesian and Müllerian mimicry were enunciated many years ago and might well be reconsidered in the light of the more recent and very considerable advances made in such fields as genetics, ecology, insect physiology and pathology.

Genus **MELINAEA** Hübner

Melinaea Hübner, 1816 (1816–1826), p. 11. Type: *Melinaea egina* Cramer, by designation of Scudder, 1875. Doubleday, 1847 (1846–1852), p. 56. Bates, 1862, p. 549. Kirby, 1871, p. 33. Scudder, 1875, p. 215. Weymer, 1875, p. 377. Burmeister, 1878, p. 123. Godman and Salvin, 1879 (1879–1901), p. 12. Staudinger, 1885 (1884–1888), pp. 61, 71. Schatz, 1886 (1885–1892), pp. 87, 88, pl. 10. Haase, 1893, pp. 51, 53. Reuter, 1896, pp. 325, 327, 552. Thieme, 1899, p. (12). Haensch, 1899, p. (16). Stichel, 1901, p. (17). Haensch, 1909, p. 122. Punnett, 1915, p. 135. d'Almeida, 1923, p. 233. Kremky, 1925, pp. 144, 147, 149, 153, 154, 158, 178, 182, 192, 193–194, 198–199. Forbes, 1927, pp. 23–36; 1937, p. (4). Bryk, 1937, pp. 470–482. Forbes, 1940, pp. 309, 311. Fox, 1940, pp. 165, 170, 174, 178, pl. 7, fig. 34. Forbes, 1941, pp. 1–4; 1942, pp. 26–28. Fox, 1942, pp. 1–3. d'Almeida, 1942, p. 189. Fox, 1943, p. 397. d'Almeida, 1945, pp. 12–13. Fox, 1945, pp. 1–2. Forbes, 1948, pp. 1–24. d'Almeida, 1951, pp. 18–27. Bryk, 1953, pp. 26–28. Fox, 1956, pp. 9, 22.

Czakia Kremky, 1925, pp. 147, 149, 153, 158, 176–177, 192–193, 194. Type: *Czakia mediatix* (Weymer), by monotypy. Bryk, 1937, pp. 482–483. d'Almeida, 1940, pp. 758–759. Fox, 1940, p. 178. d'Almeida, 1942, p. 181.

Mechanitis (part), Doubleday, 1847 (1846–1852), p. 130.

Eueides (part) Hübner, 1816 (1816–1826), p. 11.

Heliconia (part), Latreille, 1819 (*In* Latreille and Godart, 1819–1823), pp. 216, 221. Doubleday, 1847 (1846–1852), p. 104.

Papilio (part), Cramer, 1779 (1775–1791), p. 144.

The palpus (fig. 1) is carried closely appressed to the head. The first joint is long and lightly curved, the second joint a fifth longer and also lightly curved; the third joint is strongly reduced, present as a minute knob at the end of the middle joint.

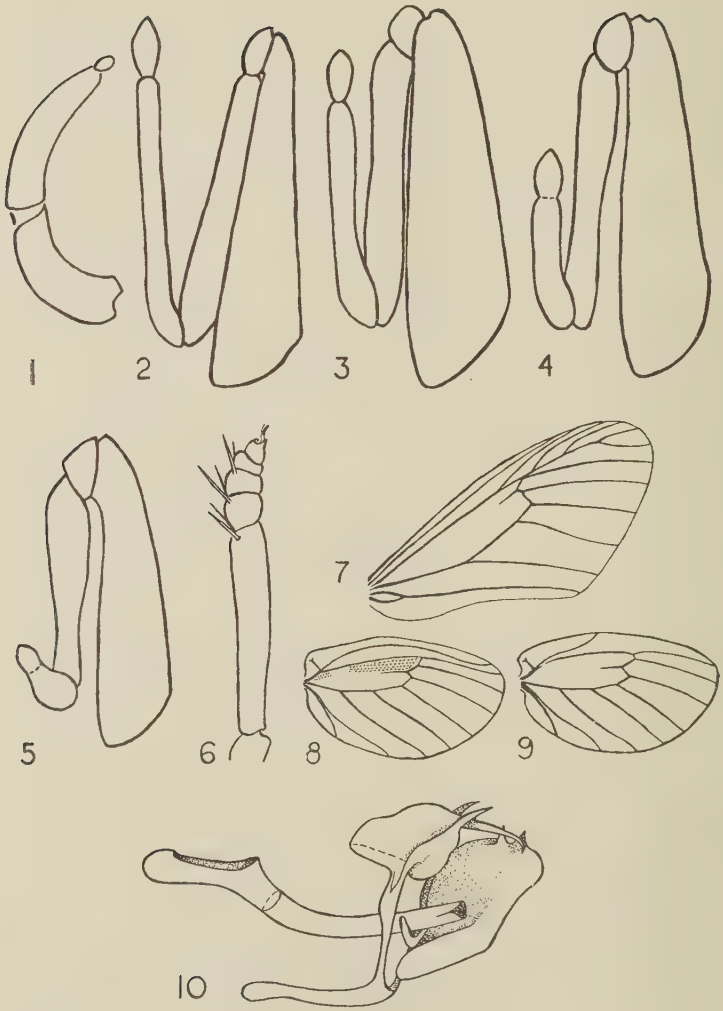
The male foreleg (figs. 2, 3, 4, 5) has the femur plus trochanter always shorter than the coxa; the tibia always is shorter than the femur. Within the genus there is a great deal of variation in the degree of reduction, much of which is individual rather than characteristic of the species. Once in a while a specimen will be found having the forelegs asymmetric. In *M. menophilus orestes* (fig. 2) the tibia and tarsus are as fully developed as may be found in the genus, with the tarsus articulate although reduced to a short joint. In *M. egina* (fig. 5) reduction is carried to an extreme with the articulation between tibia and tarsus completely lost, the two joints being fused into a single unit only about two-thirds the length of the femur. Most specimens will fall between these extremes as illustrated by *M. m. menophilus* (fig. 3) or *M. l. messatis* (fig. 4).

The female foreleg (fig. 6) has the tibia a little shorter than the femur, the tarsus three-fifths the length of the tibia. The fifth tarsal joint is evident and bears a tiny pulvillus and claws. Paired spines are present on the first three tarsal joints; the first joint is twice the length of the other four together; the second, third, and fourth joints are discoid, the second longer than either of the others; the fifth joint is cylindrical and lightly tapering.

On the forewing (fig. 7), R_2 branches at, or more usually just beyond, the end of the cell; 1d is minute or wanting so that M_1 seems to branch directly from R; 2d is deeply angled at its midpoint or just below it, with a strong Mr from the angle; 3d is lightly sinuate. The cubitus is apparently three-branched, with Cu_1 strongly sinuate and widely spaced from Cu_2.

On the hind wing the cubitus is apparently four-branched. The humeral vein is strong, erect, and lightly forked. In males (fig. 8) Sc and R separate at the base with the humeral placed at or just beyond their separation, and Sc runs to the margin at the apex of the wing in a long, sweeping curve. In females (fig. 9) Sc and R run close together, though not coalesced, for a very short distance beyond the humeral, then Sc sweeps up and runs out to the costal margin less than halfway to the apex. 1d is always present but generally is shorter than the other two; 2d is the longest, is deeply angled and bears a strong Rc. Males have the hair patch divided with the basal patch small and pencil-like, the distal patch long and placed in the outer half of the cell.

Male genitalia (fig. 10).—The tegumen and uncus are fused; the uncus is very slender with a terminal down-curved hook; the tegumen is hood-like. The anterior side of the annulus is kneed. The saccus is about the same length as the tegumen plus uncus. A remarkable paired structure points posterior from the base of the tegumen-uncus, its basal two thirds wide and flat, articulating closely with the inner face of the valve below its costal margin, terminating in a long, sharp tooth. This paired structure articulates with the valve so closely that it often seems to be a part of it, but dissection shows that it supports the end of the enteron (the drawing was made from a preserved, somewhat hardened specimen) and is, therefore, possibly an unusual development of the gnathos and thus would be homologous with the gnathos found in *Tellervo, Patricia*, and the Dircennini. The



Figs. 1–10. Fig. 1—*Melinaea egina,* palpus of male; figs. 2–5—forelegs of males showing some stages of reduction (2. *Melinaea menophilus orestes,* 3. *Melinaea menophilus menophilus,* 4. *Melinaea lilis messatis,* 5. *Melinaea egina*); fig. 6—*Melinaea egina,* fore tarsus of female; figs. 7–9—venation of *Melinaea egina* (7. forewing, 8. hind wing of male, 9. hind wing of female); fig. 10—*Melinaea lilis imitata,* male genitalia, left valve removed.

valve itself is suboblong—usually with a pair of short, sharp teeth on the inner face of the costa placed toward, but not at, the apex; the sacculus is evenly curved. The rather narrow juxta is V-shaped. The penis is twice the length of the tegumen-uncus, is strongly up-curved near its midpoint, and is more or less S-shaped; the foramen is about one-fourth to one-fifth the length of the penis. Valves sometimes are asymmetric. A certain amount of individual variation is noted within almost any of the species, particularly in the length of the saccus or of the penis in relation to the tegumen-uncus.

Haensch's treatment of the genus (1909) in Seitz was completely unsatisfactory. Forbes (1927) presented a cohesive revision recognizing thirteen species; his emendation (1948) added the new names recorded during the intervening twenty years. Bryk's list (1937) followed Forbes' arrangement. d'Almeida (1951) reviewed a part of the genus. The present revision includes all the names proposed for the genus to the date of writing and divides them into eighteen species.

Neither the legs nor the male genitalia appears to offer much help in sorting out the species in *Melinaea*. In both structures variation is largely quantitative rather than qualitative and the range of individual variation found within a species often is great. In the few instances where the legs—as in *M. ethra*—or the male genitalia—as in *M. comma*—are distinctive, the species involved is easily recognized without reference to these structures. It has been necessary, therefore, to depend on pattern morphology to arrive at an analysis of the species; while this procedure probably is rather less objective than the use of the male genitalia or the legs, and is much more difficult to apply, the results obtained in *Melinaea* seem to be much more satisfactory than those produced by the same procedure in *Elzunia*.

Forbes (1927) first called attention to the taxonomic importance of the marginal spots in *Melinaea*. These are present in eight of the species as small white dots paired between the veins, either set in a solid background or ringed with black (figs. 11, 12). They are found on both sides of the wings in only a few forms. The trend is to lose them first on the upper side of both wings, then on the under side of the forewing. In some individual specimens of *maelus purusana* the last vestiges of the

paired submarginal dots may be seen on the under side of the hind wing as tiny black dots connected by lines to the marginal black (fig. 13). Many of those species lacking the marginal dots have the marginal band very narrow, frequently toothed at the veins (fig. 14). A quite different development is found in *maelus* and *phasiana:* the marginal elements on the forewing only have become enlarged tawny spots, tending to fuse into single spots between the veins (as in fig. 15).

The most posterior member of the marginal series on the forewing, situated below Cu_2 in the anal angle, appears to be lacking in *Melinaea.* The separate yellow, white, or tawny spot frequently occupying that position probably is a member of the same morphologic series to which the subapical spots belong, displaced distad.

M. thera has a complete series of pale spots in the marginal position. Certainly those in the apex of the forewing are the subapical spots, the one below Cu_2 is the anal spot. The two spots between M_3 and Cu_2 on the forewing and the series on the hind wing might be homologized in one of two ways: either they are distally displaced spots belonging to the same series as do the subapical spots, or they are the true marginal spots enlarged and fused, carrying further the developmental trend found in *maelus* and *phasiana. M. lucifer* preserves these spots as developed in *thera* only on the forewing, lacking those on the hind wing.

Another useful pattern element is the black longitudinal bar placed at the hind margin of the forewing. In its complete form this bar runs from the base of the wing out to the anal angle and covers the margin below the anal vein and half of the longitudinal cell between the anal vein and cubitus-Cu_2. In some species only the outer part of this bar is retained, leaving the proximal half or more of the anal margin tawny, as in *egina.* In

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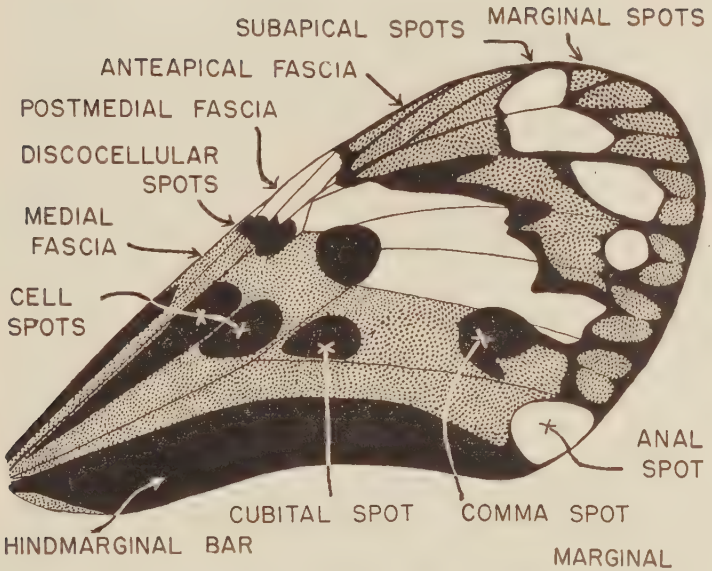
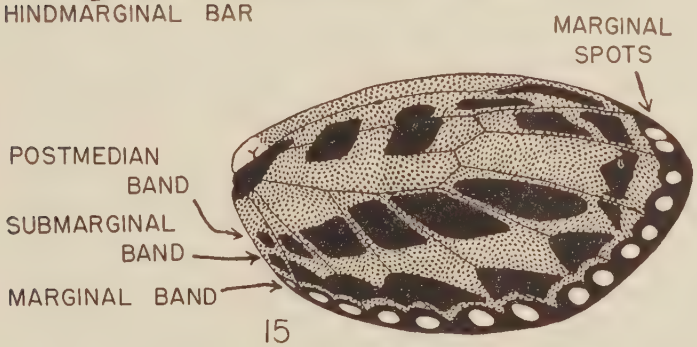
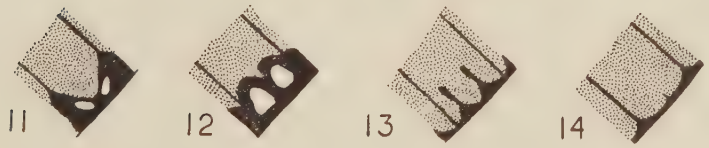
Figs. 11–14. Detail of pattern of hind wings showing variations in the marginal elements between Cu_1 and M_3. Fig. 11—*Melinaea mneme mneme;* fig. 12—*Melinaea lilis messatis;* fig. 13—*Melinaea maelus purusana;* fig. 14—*Melinaea menophilus menophilus.*

Fig. 15. Fore and hind wings of a non-existent *Melinaea* to illustrate the pattern elements and the descriptive terminology used for them.


SUBAPICAL SPOTS
MARGINAL SPOTS
ANTEAPICAL FASCIA
POSTMEDIAL FASCIA
DISCOCELLULAR SPOTS
MEDIAL FASCIA
CELL SPOTS
ANAL SPOT
CUBITAL SPOT
COMMA SPOT
HINDMARGINAL BAR


MARGINAL SPOTS
POSTMEDIAN BAND
SUBMARGINAL BAND
MARGINAL BAND

15



11 12 13 14

other species only the proximal part of the bar is retained leaving the distal half or more of the hind margin tawny, as in *menophilus*. Only in *lilis* is this character inconsistent; the bar is complete in some subspecies, incomplete in others, while in *M. l. erica* both conditions are present in the series in the British Museum (Natural History).

Figure 15 presents a generalized pattern for *Melinaea* in order to explain the terminology for the pattern morphology used herein. This terminology is for convenience in description and does not attempt to show morphologic derivations of the elements, or their homologies, a subject to be explored at another time.

A study of this sort should try to arrange the species of the genus in an evolutional sequence, presenting the most primitive first and thence proceeding in an orderly fashion to the most advanced. Since the wing pattern is a morphologic unit or series of related units, it is reasonable to postulate that it behaves in evolving much as do other morphologic units. Thus the wing pattern of the species within the genus would be expected to evolve by the loss of elements rather than by the addition of new elements. The most primitive species must be, therefore, the one most completely preserving the greatest number of pattern elements.

A review of the above discussion of pattern elements suggests the description of the hypothetical primitive species: it should have the marginal spots on both sides of both wings as small white dots; the pale anal spot of the forewing should be present; the anteapical fascia of the forewing should be represented by a series of spots and not suppressed by the black coloring; the hindmarginal bar of the forewing should be complete from base to anal angle; the hind wing should have three distinct bands—the postmedian, the submarginal, and the marginal. The two black discocellular spots of the forewing should be separated and distinct, this condition surely being more primitive than when they are fused into a continuous black band. Both the comma mark and the cubital spot should be present and distinct.

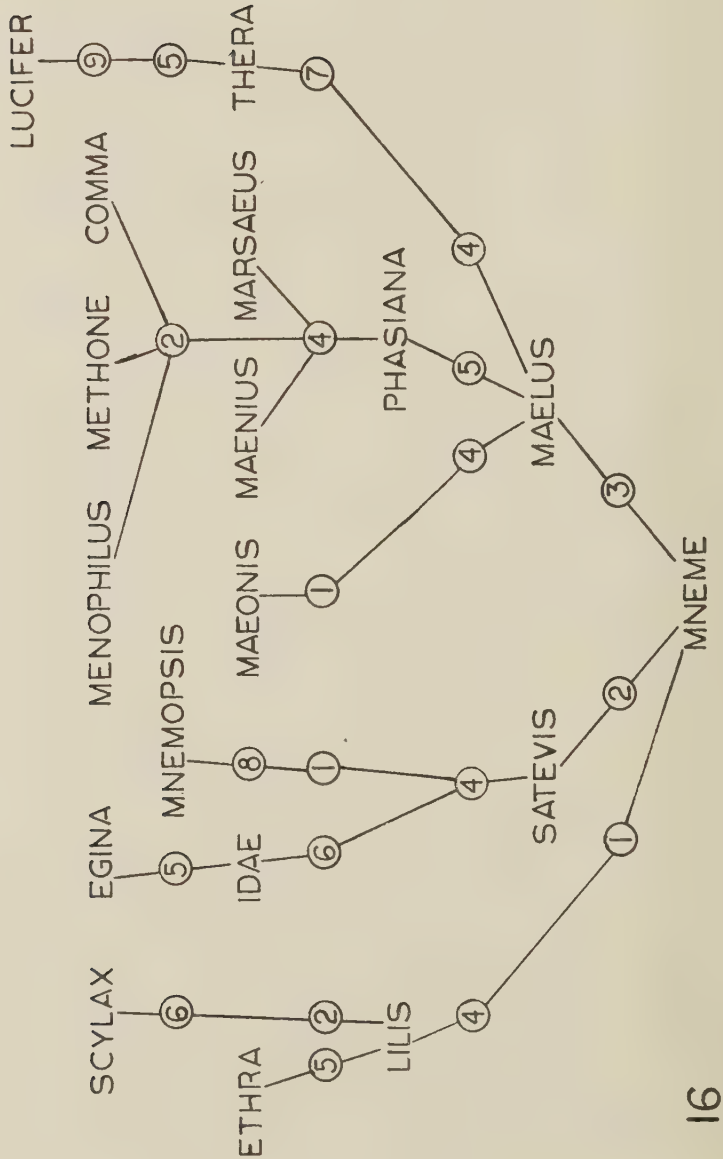
No one species in *Melinaea* meets the above requirements perfectly, which is not surprising. The ancestral species surely can-

not be flying today. One species comes fairly close to the specifications: *Melinaea mneme.* No other species fits quite so well.

Figure 16 summarizes the evolutional relationships of the species. It is not really a chart of descent: *phasiana* is not the "grandchild" of *mneme.* Rather it is intended to illustrate general structural relationships as exemplified by the pattern, and perhaps the lines connecting the species might best be interpreted as showing cousinly relationships rather than lines of descent.

From figure 16 it is seen that *lilis, ethra,* and *scylax* form a group; *mneme* and *satevis* are rather close and *idae, egina,* and *mnemopsis* probably were derived from the same stock. *M. maelus* differs from *mneme* only in that the paired white marginal dots have been lost or are vestigial (fig. 11). *M. maeonis* stands alone but must have derived from something like *maelus. M. phasiana,* in losing the anal spot, represents the kind of modification leading to *maenius, marsaeus, menophilus, methone,* and "copy-cat" *comma. M. thera* and *M. lucifer* are highly modified with the apparent marginal elements present as single round spots; they might have had a *maelus*-like ancestor.

The following key differentiates the species and subspecies of *Melinaea* on the basis of the criteria discussed above.


LUCIFER
9
5
THERA
7
COMMA
METHONE
2
MARSAEUS
4
PHASIANA
5
4
MAELUS
3
MENOPHILUS
MAENIUS
4
MAEONIS
1
MNEME
EGINA
5
MNEMOPSIS
8
IDAE
6
1
4
SATEVIS
2
1
SCYLAX
6
2
ETHRA
5
LILIS
4

16

Key to the Species and Subspecies of Melinaea

1. Both wings with a complete series of round, pale marginal spots placed singly between the veins ..... (*M. thera*) ... 2
   White marginal spots placed in pairs between the veins, present at least on the under side of the hind wing and frequently also on the forewing and on the upper side 3
   White marginal spots not present on either side of hind wing, the border frequently linear, sometimes absent 22
2. Marginal spots yellow on the upper side of both wings and on the under side of the forewing, white on the under side of the hind wing. *M. t. eratosthenes*
   Marginal spots white on both sides of both wings, but tending to be weak on the upper side of the hind wing ..... *M. t. thera*
3. No separate white or yellow spot in the anal angle of the forewing, but the white paired marginal spots often present in the anal angle on the under side 4
   A separate white or yellow spot in the anal angle of the forewing, the marginal spots never present there 7
4. Hind margin of the forewing entirely black; a single yellow subapical spot present; yellow postmedial fascia wide, ovoid; black comma mark elongated and club-shaped; cubital spot small, triangular; hind wing bright yellow on the disc above the black median band. *M. ethra*
   Hind margin of forewing entirely black; cubital spot large, greatly elongated 11
   Hind margin of forewing above mostly tawny, with black only on the distal half, or less ..... (*M. egina*) ... 5
5. Basal half of forewing tawny, including the end of the cell and the base of Cu_1-Cu_2, except a small black spot there ..... *M. e. agricola*
   Basal third of forewing tawny, with the end of the discal cell and the base of Cu_1-Cu_2 yellow; no black spot in Cu_1-Cu_2 6

Fig. 16. Phylogenetic chart of the genus *Melinaea*. Numerals indicate steps in structural evolution from previous conditions, as follows: 1. The submarginal band of the hind wing is lost. 2. The hindmarginal bar of the forewing is shortened. 3. The marginal series of paired dots is lost. 4. The anteapical fascia of the forewing is suppressed. 5. The anal spot of the forewing is lost. 6. The postmedian band of the hind wing is lost. 7. A series of single, round spots is present in the marginal position, probably derived from the distad migration of the submarginal series. 8. The postmedian band of the hind wing is reduced to its apical elements. 9. The series of round spots in the marginal position is lost on the hind wing and reduced in number on the forewing.

6. Hind wing with a series of six (sometimes five) separate black postmedian spots, the second (M_2-M_3) being much the largest. *M. e. paraiya*

   Hind wing with a series of five (sometimes six) separate black postmedian spots, the third (M_3-Cu_1) being the largest .. *M. e. manuelito*

   Hind wing with the black postmedian spots in M_3-Cu_1 and Cu_1-Cu_2 fused with the marginal black to form a patch preceded by one or two small separate spots ..... *M. e. egina*

7. Hind margin of forewing above entirely black, or if tawny on the proximal part, the spot in the anal angle is white 8

   Hind margin of the forewing above mostly tawny, with only the distal third or less black 17

8. Black spot in the base of Cu_1-Cu_2 of the forewing above is elongated and often forms a continuous band with the spots in the discal cell, or is incorporated as a part of the black distal half of the wing; or if the cubital spot is small and round it is placed well away from the inner corner of Cu_1-Cu_2; marginal white spots strong on the under side and often present above ..... (*M. lilis*) ... 9

   Black cubital spot of the forewing above is rounded or triangular, always filling the inner corner of Cu_1-Cu_2, never connected with the spots in the discal cell nor incorporated with the black areas beyond it; marginal spots never present on the upper side and tend to be small on the under side, the series not always complete .. *M. mneme*

9. Postmedial spots or fascia of the forewing white 10

   Postmedial spots or fascia of the forewing yellow 11

10. Black postmedian band of the hind wing complete to the base. *M. l. parallelis*

    Black postmedian band of the hind wing incomplete or obsolete above and never reaching Cu_1 on the under side ..... *M. l. messatis*

11. Forewing with a long black spot in the base of Cu_1-Cu_2 continuous with the streak in the discal cell or separated from it only by the tawny cubitus, forming a straight band which also is fused (or nearly) at its distal end with the comma mark; yellow postmedial spot in M_2-M_3 almost always completely separated from the rest of the light band 12

    Black cubital spot of forewing shorter, well separated from the comma mark and rarely touching the cell streak; the yellow postmedial fascia continuous, not broken into spots 15

12. Yellow postmedial fascia of forewing entirely broken into a series of separate spots 13

    Yellow postmedial fascia of forewing not broken into spots above M_2 14

13. Hind margin of forewing broadly black to the base; median band of hind wing strong, complete to the base ..... *M. l. dodona*

    Hind margin of forewing either complete or basally tawny; median band of hind wing not reaching the base ..... *M. l. erica*

14. Upper side of hind wing with strong yellow scaling above the median band ..... *M. l. flavicans*
Upper side of hind wing all tawny above the median band. *M. l. imitata*
15. Postmedian yellow fascia of the forewing much wider than the black band separating it from the subapical spots; in aberration *lateapicalis* Hall, the postmedian fascia is fused with the subapical spots, leaving nearly all the apex yellow ..... *M. l. sola*
Postmedian yellow fascia of forewing no wider than the black band separating it from the subapical spots 16
16. Yellow markings in apical third of forewing above edged with tawny scaling, the black element over M_3 replaced by tawny; on the under side nearly all black markings in the apical third of the wing replaced by coppery tawny ..... *M. l. ezra*
Yellow and black markings in the apical third of the forewing cleanly edged above and below, not margined nor replaced by tawny scaling. *M. l. lilis*
17. Postmedial fascia of the forewing complete from the costa to M_3-Cu_1 near the margin, so that there is no separate light spot in M_3-Cu_1 .. 18
Postmedial fascia of the forewing shortened, leaving a separate spot in M_3-Cu_1 20
18. Base of Cu_1-Cu_2 of forewing almost completely filled with a large triangular black spot ..... *M. scylax*
Base of Cu_1-Cu_2 of forewing with only a small round black spot which does not fill the area ..... (*M. satevis*) ... 19
19. Hind wing nearly all black, leaving only small tawny patches at the base and near the apex; ground color of these spots and of the forewing a tawny ochre ..... *M. s. crameri*
Hind wing nearly all tawny, with only the broad borders black; ground color a tawny mahogany ..... *M. s. satevis*
Hind wing with postmedial and marginal series present as separate bands; ground color a pale tawny ochre ..... *M. s. aurantia*
20. Black discocellular spots of the forewing large, fused with each other, and with the black Cu_1-Cu_2 to cut off the costal part of the postmedian fascia as a separated spot ..... *M. mnemopsis*
A large yellow patch in the middle of the forewing comprised of the costal part of the postmedian fascia, the end of the discal cell and the proximal half of Cu_1-Cu_2, with the small round black discocellular spots standing separated in it ..... (*M. idae*) ... 21
21. Black of hind wing quite broad, including the distal two thirds of M_3, its inner edge fading gradually into the tawny discal color .. *M. i. idae*
Black of hind wing narrower, including only the distal one third of M_3, its inner edge sharp and cleanly defined ..... *M. i. vespertina*
22. A black-ringed yellow spot in the anal angle of the forewing above .. 23
No ringed yellow spot in the anal angle of the forewing above 30

23. Anteapical elements of forewing not present .... (*M. maeonis*).... 24
Anteapical elements of forewing present ..... (*M. maelus*) ... 25
24. Pale bar in the end of the forewing discal cell tawny, the light color above the hind wing postmedian band yellowish tawny.
M. m. maeonis
Pale bar in the end of the forewing discal cell clear yellow; the light color above the hind wing postmedian stripe muddy yellowish tawny.
M. m. borealis
Pale bar in the end of the forewing discal cell and the light color above the hind wing postmedian band both clear yellow .... *M. m. zamora*
25. Light postmedian fascia of forewing tawny, sometimes with limited yellow scaling near the costa 26
Light postmedian fascia of forewing clear yellow 28
26. Black in the apical third of the forewing reduced to outlines around the yellow subapical spots, along the postmedian fascia and over the veins, with a series of tawny spots along the outer margin and in the more usually dark postmedian band ..... *M. m. cydon*
Black of the distal third of the forewing solid except for a few light scales in the dark postmedian band costad of M_3 27
27. Ground color orange tawny; postmedian tawny fascia as wide as the distance between Cu_1 and Cu_2; black discocellular spots separate.
M. m. mayi
Ground color reddish tawny; postmedial tawny fascia much narrower than the distance between Cu_1 and Cu_2; black discocellular spots fused into a band ..... *M. m. brunnea*
28. End of forewing cell and an area in Cu_1-Cu_2 yellow, forming a band connected to the postmedian fascia ..... *M. m. madeira*
End of forewing cell and the light area in Cu_1-Cu_2 tawny with some slight yellow scaling 29
29. Ground color dark mahogany; hind wing with postmedian and marginal bands narrow, leaving a wide band of ground color between them ..... *M. m. purusana*
Ground color orange mahogany; hind wing with postmedian and marginal bands wide, leaving little ground color between them.
M. m. maelus
30. Single round light marginal spots on the forewing in Cu_1-Cu_2 and M_3-Cu_1; these spots may be partially incorporated with the tawny ground color, in which case their positions are recognizable from the shape of the black border, which is scalloped in over the veins.
(*M. lucifer*) ... 31
No separate light marginal spots on the forewing between M_3 and Cu_1, the border widely black or scalloped in between the veins 33
31. Marginal spots in M_3-Cu_1 and Cu_1-Cu_2 of forewing tawny, only the anterior one fully separate on the upper side, the posterior one widely fused with the tawny ground color, but both separate on the under side; comma mark reduced to a triangular spot connected to the margin by a very thin line ..... *M. l. eryx*

Marginal spots in M_3-Cu_1 distinct above, separated from ground color on both sides, and often containing yellow scales 32

32. Yellow on forewing restricted to the large apical patch and to the outer part of the postmedian fascia; no yellow present in the end of the discal cell or in Cu_1-Cu_2 ..... *M. l. lucifer*

Postmedian band of forewing entirely yellow; yellow scaling prominent in Cu_1-Cu_2 and in the end of the discal cell ..... *M. l. lutzi*

33. Hind margin of forewing entirely black, or a vestigial yellow anal spot present on the under side 34

Hind margin of forewing tawny at least on its distal fourth; no vestige of the anal spot on the underside 44

34. Discocellular spots of forewing separated, unfused; no anal spot present ..... (*M. maenius*) ... 35

Discocellular spots of forewing fused into a band; or with a vestigial anal spot 40

35. Hind wing with a large black patch between M_2 and the inner margin, with only a little tawny ground color within it, or none at all ... 36

Hind wing with the postmedian band well separated from the submarginal band, or the latter wanting 37

36. Black patch of hind wing nearly solid, only some slight tawny along the anteriormost parts of the veins; in cell M_1-M_2 of hind wing there is a small triangular spot placed about one third of the distance out to the margin; black marginal line very thin ..... *M. m. cocana*

Black patch of hind wing crossed by tawny veins and the postmedian series separated from the submarginal series by a very narrow tawny band; in M_1-M_2 of hind wing is a small triangular spot placed about two thirds of the distance out to the margin; black marginal line several millimeters wide ..... *M. m. maenius*

37. Forewing with tawny (sometimes yellowish) subapical spots. *M. m. hicetas*

Forewing with the apex all black 38

38. Postmedian yellow fascia of forewing no wider than the black discocellular spots preceding it; black postmedian band of hind wing vestigial on the under side ..... *M. m. tarapotensis*

Postmedian yellow fascia of forewing much wider than the black discocellular spots preceding it; black postmedian band of hind wing present on the underside 39

39. Hind wing with the postmedian band strong, the small element in M_1-M_2 always present; submarginal band often present. *M. m. pothete*

Hind wing with the postmedian band weak or vestigial on the upper side, element in M_1-M_2 and the submarginal series wanting. *M. m. juruaensis*

40. Tawny anteapical elements of forewing present .. (*M. phasiana*) ... 41

Anteapical elements of forewing not present .... (*M. marsaeus*) ... 42

41. Postmedian fascia of forewing yellow ..... *M. p. manga*

Postmedian fascia of forewing tawny ..... *M. p. phasiana*

42. Hind wing all tawny, only the narrow border black; postmedian fascia of forewing tawny, subapical spots wanting ..... *M. m. clara*
Hind wing with postmedian and submarginal bands separately present 42A
Hind wing with a large black patch covering most of the wing 43
42A. Subapical spots tawny, postmedian fascia yellow .... *M. m. marsaeus*
Both subapical spots and postmedian fascia yellow ..... *M. m. egesta*
43. Forewing postmedian fascia tawny, yellow subapical spots more or less fused into a single patch ..... *M. m. rileyi*
Forewing postmedian fascia yellow; yellow subapical spots separated from one another ..... *M. m. macaria*
44. Comma mark of forewing connected to its marginal triangle by a black line placed on or very near Cu_1 and running from the top of the comma mark ..... (*M. comma*) ... 45
Comma mark of forewing connected to its marginal triangle by a black line placed well away from Cu_1 and running from the middle of the comma mark 47
45. Hind wing with a separate series of postmedial and submarginal black spots ..... *M. c. comma*
Hind wing with a large black patch covering most of the wing, leaving only a small tawny patch near the apex 46
46. Forewing with the postmedial fascia yellow ..... *M. c. isocomma*
Forewing with the postmedial fascia tawny red ..... *M. c. simulator*
47. Cell of hind wing with at least a streak of tawny or yellow in it, but usually the entire cell is tawny ..... (*M. menophilus*) ... 48
Cell of hind wing black above and below ..... (*M. mothone*) ... 50
48. Postmedian fascia of forewing tawny ..... *M. m. orestes*
Postmedian fascia of forewing yellow 49
49. Hind wing with the postmedian series vestigial or wanting; submarginal black series wanting ..... *M. m. zaneka*
Hind wing tawny with the postmedian and submarginal series complete ..... *M. m. menophilus*
50. No yellow present on the forewing, the postmedian fascia tawny red. *M. m. mothone*
Postmedial fascia of the forewing yellow ..... *M. m. messenina*

Melinaea mneme (Johansson) Plate II, figs. 29, 30.

This low altitude species is found (fig. 17) along the Guiana coast and throughout the Amazon valley as far west as Teffé; apparently it is missing from the interior highlands of Guiana.

Papilio mneme Johansson, 1763, p. 403; "China". Linné, 1764, p. 235; 1767, p. 756. Sulzer, 1776, pl. 16, figs. 3, 4. Fabricius, 1781, p. 27; 1787, p. 160; 1793, p. 160.
Heliconius mneme, Latreille, 1820 (1819–1823), pp. 200–201, 221.
Mechanitis mneme, Doubleday, 1847 (1846–1852), p. 130.

Melinaea mneme, Butler, 1869, p. 124. Kirby, 1871, p. 34. Butler, 1873, p. 154. Poulton, 1903, pp. liv, lv. Kaye, 1907, pp. 413–417, 419, 425, 430, 432–433, pl. 23, fig. 6, pl. 24, fig. 6, pl. 25, fig. 6, pl. 26, figs. 1–7; 1925b, p. xxii. Bryk, 1937 (part), p. 480.

Papilio harmonia, Herbst (not Johansson), 1790, p. 116, pl. 70, figs. 1, 2.

Melinaea mediatrix Weymer, 1890, pp. 282–283; Cayenne. Haase, 1893, pp. 51, 53. Haensch, 1909, p. 123, pl. 33b. Forbes, 1927, pp. 25, 26, 28, 30. Fox, 1940, p. 170. d'Almeida, 1942, p. 181.

Czakia mediatrix, Kremky, 1925, pp. 192, 193, 194, 271, figs. 42, 43, pl. 21, fig. 5. Bryk, 1937, p. 482.

Melinaea mauensis Weymer, 1890, pp. 282–283. Haensch, 1909, p. 123. Kaye, 1925a, p. 413; 1925b, pp. xxii, xxiii. Forbes, 1927, p. 24, 31, pl. 3. Fox, 1940, p. 179.

Czakia mediatrix mauensis, Bryk, 1937, p. 482.

Melinaea mediatrix anina Haensch, 1909, p. 123. Forbes, 1927, pp. 24, 31. Fox, 1940, p. 179.

Czakia mediatrix mauensis anina, Bryk, 1937, p. 483.

The type of *mneme* was stated by Kaye (1925) to be in the Linnean Society collection. The types of *mediatrix, mauensis* and *anina* are in the Berlin Museum.

Papilio mneme (Johansson) has been widely misidentified for many years. Godman and Salvin (1898) were first to notice that Cramer (1779 (1775–1791)) figured as *mneme* an entirely different species from Guiana, and they named this second insect *crameri.* Weymer (1890) previously had accepted Cramer's identification and believing that true *mneme* was without a name called it *mediatrix.* Haensch (1909) preserved the error although the English entomologists of that time understood the correct application of the original name and Kaye (1907) illustrated it in ten figures, some in color. Kaye (1925) presented a formal synonymy based on reexamination of the Linnean collection.

Weymer's *mediatrix* is an absolute synonym. *M. mauensis* is a normal variation of *mneme* in which the postmedian band of the hind wing is separated from the submarginal band so that a tawny band appears between them; in typical *mneme* these bands are fused into a large patch. *M. anina* Haensch is a further aberration in which the yellow postmedian fascia of the forewing is divided into two separate spots while the hind wing is like that of *mauensis.* Both of these names fall as synonyms because they indicate aberrations.

The black pigmentation in this subspecies is exceedingly variable. At one end of the scale are individuals like the one Haensch figured (1909, 33b, as *mediatrix*) with the hind wing covered by a large black patch and no anteapical tawny on the forewing; at the other extreme are individuals with the postmedian and submarginal bands of the hind wing well separated by a band of tawny ground color and a prominent anteapical tawny fascia on the forewing. In almost every part of the range of *mneme* (fig. 17) both variations are to be found and all degrees of variation between the extremes. The proportional composition of the geographic populations indicates a clinal distribution, as the following table indicates.

	Specimens examined	Hind wing black bands separate	Forewing anteapical elements present
French Guiana	39	16%	11%
Northern Para	6	17%	0%
Coastal British Guiana	76	72%	49%
Venezuelan Guiana ...	11	91%	86%
Amazon basin	53	92%	61%

Thus in French Guiana and nothern Para (the coastal lowlands of Brazil north of the Amazon) most of the *mneme* populations are heavily black with the anteapical fascia unusual. In British Guiana about half the specimens have the anteapical fascia and about a quarter have the hind wing black bands separated. In Venezuelan Guiana and the Amazon basin the black patch occurs in less than one tenth of the specimens and about two thirds have the anteapical tawny elements. This is a fine example of geographic variation which should *not* be named.

The British Museum (Natural History) has an aberrational specimen from Rio Madeira in which the postmedian fascia and subapical spots of the forewing are tawny rather than yellow.

Specimens examined: [1]

[1] The following abbreviations are used to indicate the collections from which data have been recorded in this study: A.M.N.H., the American Museum of Natural History, New York, New York; A.N.S.P., Academy of Natural Sciences of Philadelphia, Pennsylvania; B.M., the British Museum (Natural History), London, England; C.M., Carnegie Museum, Pittsburgh, Pennsylvania; C.U., Department of Entomology, College of Agriculture, Cornell University, Ithaca, New York; I.O.C., Instituto Oswaldo Cruz, Rio de Janeiro, Brazil; M.C.Z., Museum of Comparative Zoology, Harvard

British Guiana: Kartabo woods (A.M.N.H., C.M.), 36 ♂. Wismar, Demarara River (A.M.N.H.), 1 ♂. Hice estate (A.M.N.H.), 2 ♂. Rockstone, Essequibo River (A.M.N.H.), 4 ♂. Bartica (A.M.N.H., B.M., C.M.), 3 ♂, 1 ♀. Kuruhung (A.M.N.H.), 1 ♂. Tumutumari (C.M.), 1 ♂. Azuma (A.M.N.H.), 1 ♂. Kuyuwini River (A.M.N.H.), 2 ♂. Quonga (B.M.), 3 ♂, 2 ♀. Mabaruma (B.M.), 2 ♂. Omai (B.M.), 2 ♀. Boschland (B.M.), 1 ♂. Carmang River (B.M.), 2 ♂. Without locality (B.M., C.M.), 6 ♂, 3 ♀.

Venezuelan Guiana: Paruima (C.M.), 6 ♂. Adoro River (C.M.), 1 ♂. Rio Suapure (M.C.Z.), 3 ♂, 1 ♀.

Dutch Guiana: Saramacca River (B.M.), 1 ♂, 3 ♀.

French Guiana: St. Laurent (B.M.), 2 ♂, 5♀. Maroni River (A.M.N.H., B.M.), 6 ♂. Pied Saut, Oyapok River (C.M.), 2 ♂, 2 ♀. Mana River (C.M.), 5 ♂, 2 ♀. Without locality (A.M.N.H., B.M., M.C.Z., Z.S.B.), 15 ♂, 2 ♀.

North Para: Upper Rocana River [Rio Arocaua] (C.M.), 3 ♂, 3 ♀.

Brazil: Paramiribo (B.M., Z.S.B.), 1 ♂, 1 ♀. Santarem (A.M.N.H., B.M., C.M.), 5 ♂. Obidos (A.M.N.H., B.M., Z.S.B.), 8 ♂, 3 ♀. Manaos (Z.S.B.), 1 ♂. Teffé [Ega; Rio Solimoes] (B.M., M.C.Z., Z.S.B.), 18 ♂, 4 ♀. Pebas (B.M.), 1 ♀. Rio Madeira (B.M.), 1 ♂. Manicore, Rio Madeira (Z.S.B.), 1 ♀. San Antonio, Rio Madeira (B.M.), 3 ♂. Allianca, Rio Purús (B.M.), 1 ♀. Sebastopol, Labrea, Rio Purús (B.M.), 2 ♀. Hyatanahan, Rio Purús (C.M.), 1 ♂. Manacapuru, Rio Purús (C.M.), 3 ♂. Nova Olinda, Rio Purús (C.M.), 1 ♂. Villa Nova (B.M.), 1 ♂, 1 ♀. Maues (B.M.), 1 ♂. Rio Caiary-Uaupes (C.M.), 3 ♂. Amazons (M.C.Z., Z.S.B.), 27 ♂, 17 ♀. Without locality (C.M.), 1 ♂.

No Data: (A.M.N.H., C.M.), 3 ♂.

Melinaea lilis Doubleday and Hewitson

This polytypic species is distributed (fig. 18) from southern Mexico to Bolivia and along the northern coast east to Trinidad. Apparently it is missing from the Amazon basin and appears only in the valleys of the Andean foothills. There are nine subspecies now known, distinguished by Forbes (1948) in an excellent key. The most northerly subspecies is *flavicans* of the Vera Cruz coast of Mexico. Its range lies adjacent to that of *imitata;* to the east of Tehuantepec the two evidently intergrade. The latter is from Chiapas, Mexico, through Guatemala and Honduras into Nicaragua. Costa Rica and western Panama are occupied by the related species *M. scylax,* which probably de-

College, Cambridge, Massachusetts; R.P.M., Reading Public Museum and Art Gallery, Reading, Pennsylvania; U.S.N.M., United States National Museum, Washington, D. C.; Z.S.B., Zoologische Sammlung des Bayerischen Staates, Munich, West Germany.

veloped from *lilis* stock, and which partially overlaps *lilis* subspecies in range. In the Panamanian isthmus *parallelis*, a white spotted form, is found. Typical *lilis* comes from northern Venezuela and I have seen specimens from near the junction of the Cauca and Magdalena Rivers in Colombia; I do not know whether distribution is continuous between these two areas. *M. l. ezra* is found in the Santa Marta mountains in northern Colombia. Trinidad and the adjacent Venezuelian coast is occupied by *sola*. The second white-spotted form, *messatis*, is found in central and Amazonian Colombia and I have seen specimens from the Rio Putumayo and from central Peru. It is probably distributed continuously along the eastern Andean hills, but it certainly is not present in that part of eastern Ecuador where so much collecting has been done, nor in the vicinity of Iquitos on the Amazon. *M. l. erica* comes from southwestern Colombia; *dodana* is found in Bolivia.

There is a temptation to remove the two white-spotted subspecies from *lilis* and make them a separate species on the basis of the loss of the proximal part of the black hindmarginal bar of the forewing and the greatly developed black in the apical half of the forewing, along with the fragmentation of the postmedian fascia into individual spots. Both *dodana* and *erica* combine features of the yellow- and the white-spotted forms and are geographically in such a position that there is no suspicion of hybridization.

Melinaea lilis flavicans Hoffmann

Melinaea imitata flavicans Hoffmann, 1924, p. 70, fig. 3; Villa Hermosa, Tabasco and Misantla, Vera Cruz. Forbes, 1927, pp. 24, 29. Bryk, 1937, p. 473. Forbes, 1948, pp. 4, 5.

The type is in the American Museum of Natural History. The pattern and coloring is just like *imitata*, but the hind wing cell above the black medial band is yellow rather than tawny.

Specimens examined:

Mexico: Rincon, Guerrero (B.M.), 1 ♂. Atoyac, Vera Cruz (B.M.), 1 ♂. Cordoba, Vera Cruz (B.M.), 1 ♂. Agua del Obispo (A.M.N.H.), 1 ♀. Tezenana, Vera Cruz (A.M.N.H.), 1 ♂.

Melinaea lilis imitata Bates Plate II, figure 31.

Melinaea imitata Bates, 1864, pp. 55–56; Guatemala. Kirby, 1871, p. 34. Godman and Salvin, 1879 (1879–1901), p. 13, plate 2, fig. 11. Godman, 1901 (*in* Godman and Salvin, 1879–1901), p. 641. Haensch, 1909, p. 123, pl. 33c. Moulton, 1909, p. 587, pl. 30. figs. 1, 2. Kaye, 1925a, p. 413. Riley and Gabriel, 1925, p. 25. Forbes, 1927, pp. 24, 28–29. Bryk, 1937, p. 473. Fox, 1939, pp. 73–74; 1940, p. 179. Forbes, 1948, pp. 4, 5.

Melinaea lilis, Butler and Druce (not Doubleday and Hewitson), 1874, p. 334.

Melinaea tachypetis Felder and Felder, 1865 (1864–1867), p. 353; Mexico. Kaye, 1904, pp. 163–164. Bryk, 1937, p. 473.

Melinaea telchinia Boisduval, 1870, p. 31; Honduras, Guatemala, Mexico.

The types of *imitata* are in the British Museum (Natural History), a male and a female from Polochic valley, Guatemala, numbered 6976 and 6977.

The distinctive feature of the pattern is the long black bar in the proximal two-thirds of Cu_1–Cu_2 connected and continuous with the bar across the middle of the discal cell.

Specimens examined:

Mexico: Vera Paz (B.M.), 1 ♂. Oaxaco (B.M.), 1 ♂. Without locality (A.M.N.H., M.C.Z.), 2 ♂.

Guatemala: Puatalon (A.M.N.H.), 1 ♂. Puerto Barrios (A.M.N.H.), 1 ♂. Mirandilla (B.M.), 1 ♂, 1 ♀. Polochic valley (B.M.), 1 ♂. San Isidro (B.M.), 1 ♀. Pacific coast (B.M.), 1 ♀. Without locality (A.M.N.H., B.M., M.C.Z.), 3 ♂, 1 ♀.

British Honduras: Sarstoon River (B.M.), 3 ♂. Punta Gorda (B.M., C.M.), 3 ♂, 1 ♀. Without locality (C.M.), 2 ♂.

Honduras: La Libertad, Comayagua (M.C.Z.), 1 ♀. San Pedro Sula (B.M., M.C.Z.), 3 ♂, 3 ♀. Tela (A.M.N.H.), 1 ♂. Truxillo district (A.M.N.H.), 1 ♂. Belize (B.M.), 1 ♂. Without locality (C.M., M.C.Z.), 3 ♂, 1 ♀.

Salvador: San Augustin (B.M.), 2 ♂.

Nicaragua: Chonteles (B.M.), 4 ♂. Without locality (B.M.), 2 ♀.

Costa Rica: Peralta (A.M.N.H.), 2 ♂. Guapiles (C.M.), 2 ♂. Sixole River (C.M.), 1 ♂. Zent (C.M.), 3 ♂. Carillo (C.M.), 1 ♀. Colombiana (B.M.), 1 ♂. Cache (B.M.), 1 ♂. Irazu (B.M.), 1 ♂. Rio Sucio (B.M.), 1 ♀. Turrialba (B.M.), 1 ♂. Without locality (B.M.), 1 ♂, 7 ♀.

No Data or Wrong Data: (A.M.N.H., B.M., C.M., M.C.Z.), 5 ♂, 2 ♀.

Melinaea lilis parallelis Butler Plate II, figure 32.

Melinaea parallelis Butler, 1873, p. 155; Panama. Kirby, 1877, p. 697. Godman and Salvin, 1879 (1879–1901), p. 13. Haensch, 1909, p. 124. Kremky, 1925, pp. 194–198, 271, figs. 44, 45, pl. 22, fig. 2. Riley and Gabriel, 1925, p. 38. Forbes, 1927, pp. 24, 29. Bryk, 1937, pp. 473–474. Fox, 1939, p. 73; 1940, p. 179. Forbes, 1948, p. 4.

The type is a female from Panama numbered 6975 in the British Museum (Natural History).

The outer half of the forewing is black, containing spots that are white rather than yellow, and these represent the isolated subapical elements and the fragmented postmedian fascia. It differs from *messatis* by having a complete postmedian band on the hind wing. The hindmarginal bar of the forewing is reduced to its distal half, which suggests that this pattern element is being lost in *lilis* (broad sense), although it apparently serves as a valid separating character between other species in the genus.

Specimens examined:

Panama: Lion Hill (B.M.), 3 ♂, 2 ♀. Calobre (B.M.), 1 ♂, 1 ♀. Matachin (B.M.), 6 ♂. Gatun (B.M., A.N.S.P.), 2 ♂, 1 ♀. Barro Colorado Island (A.M.N.H., M.C.Z.), 2 ♂. Rio Trinidad (A.M.N.H.), 1 ♂. Colon (M.C.Z.), 1 ♂. Chiriqui (B.M.), 1 ♀. Without locality (B.M., C.M., M.C.Z.), 3 ♂, 3 ♀.

Colombia: Valdevia (B.M.), 1 ♂.

Erroneous Record: Costa Rica, Sixola (C.M.), 1 ♀.

Melinaea lilis ezra Fox Plate II, figure 33.

Melinaea lilis variation Godman and Salvin, 1880, p. 127.

Melinaea lilis ezra Fox, 1939, pp. 74–76; Minca, Department of Magdalena, Colombia; 1940, p. 179. Forbes, 1948, pp. 2–5.

The Carnegie Museum has an excellent series of this subspecies; it is confined to the Santa Marta mountains of Colombia. Most but not all specimens lack the comma mark entirely, more generally on the upper side. In the outer third of the forewing the black markings are diluted with or replaced by tawny, which gives the wing a peculiar washed-out appearance.

The types, a male and female, are in the Academy of Natural Sciences of Philadelphia.

Specimens examined:

Colombia: Department of Magdalena: Minca (A.N.S.P., C.M.), 3 ♂,

2 ♀. Hacienda Victoria, Sierra San Lorenzo (A.N.S.P.), 1 ♀. Cincinnati (C.M.), 1 ♂, 1 ♀. Bonda (C.M.), 1 ♂. Don Amo (C.M.), 3 ♂. Onaca (C.M.), 7 ♂. Vista Nieva, San Mateo (B.M.), 1 ♂. Manaure (B.M.), 1 ♂.

Melinaea lilis lilis Doubleday and Hewitson Plate II, figure 34.

Melinaea lilis Doubleday and Hewitson, 1847 (1846–1852), p. 130, pl. 17, fig. 4; Venezuela. C. and R. Felder, 1865 (1864–1867), p. 355. Kirby, 1871, p. 34. Godman and Salvin, 1879 (1879–1901), p. 13. Staudinger, 1885 (1884–1888), p. 71. Schatz, 1885 (1885–1892), pl. 10, figs. a, b, c; 1886 (1885–1892), p. 88. Haensch, 1909, p. 123. Kaye, 1925a, p. 413. Riley and Gabriel, 1925, p. 30. Forbes, 1927, pp. 24, 27, 28–29. Bryk, 1937, p. 472. Fox, 1939, p. 74; 1940, p. 179. Fox and Fox, 1947, p. 174. Forbes, 1948, pp. 3–5.

The types, a male and female from Venezuela numbered 6978 and 6979, are in the British Museum (Natural History).

The triangular black cubital spot of the forewing is always present but does not connect with either the black double spot in the discal cell or the comma mark which always is present. The postmedian fascia and the subapical spots, which are large and tend to form a band, are clear yellow and of about the same width.

Specimens examined:

Venezuela: Las Quiguas (B.M., C.M.), 9 ♂, 3 ♀. San Estevan (B.M.), 10 ♂, 2 ♀. Caracas [?] (B.M.), 1 ♂, 1 ♀. Without locality (B.M., C.M.), 2 ♂, 1 ♀.

Colombia: Sachamates, Department Cauca (A.M.N.H.), 3 ♂.

No Data: (C.M., M.C.Z.), 1 ♂, 2 ♀.

Erroneous Data: Lion Hill, Panama (B.M.), 1 ♂.

Melinaea lilis sola Kaye Plate II, figure 35.

Melinaea mneme sola Kaye 1925a, p. 413; Trinidad. Bryk, 1937, p. 481. Forbes, 1948, pp. 3, 4.

Melinaea tachypetis, Kaye (not C. and R. Felder), 1904, p. 163; 1921, p. 16, pl. 1, fig. 5.

Melinaea lilis lateapicalis Hall, 1935, p. 227; Merida, Venezuela. Bryk, 1937, p. 473. Fox, 1940, p. 179. Forbes, 1948, pp. 2, 3, 4.

Melinaea imitata limitata Hall, 1935, p. 227; Venezuela. Bryk, 1937, p. 473. Fox, 1940, p. 179. Forbes, 1948, pp. 3, 5.

The type of *sola* is in the British Museum (Natural History), as are the types of *lateapicalis* and *limitata.*

The black cubital spot of the forewing is elongated, as in *imitata*, but occupies only the proximal third of the cell and is connected with the bar in the discal cell. The comma mark is present, as in *lilis*, but the black bar in the base of M_3–Cu_1 is absent and the bar formed from the discocellular spots is much narrower and reduced, the subapical spots are small and separated, and the black between them and the postmedian fascia is narrower, so that the fascia itself is prominently wider. *lateapicalis* appears to be the extreme light form, with virtually the entire apex of the forewing yellow, while *sola* proper preserves some of the black bar beyond the postmedian fascia; *limitata* is an absolute synonym.

The subspecies is found on Trinidad and on the Sucre plateau of Venezuela to the east of the range of *M. l. lilis*. The records from Merida, Venezuela (for the types of *lateapicalis*) must be considered as probably wrong unless further collecting can verify them.

Specimens examined:

Trinidad: Without locality (B.M.), 3 ♂, 2 ♀.
Venezuela: Cumanacoa, Department Sucre (C.M.), 1 ♀. Merida (?) (B.M.), 2 ♂. Without locality (B.M.), 2 ♂, 1 ♀.
No Data: (B.M.), 1 ♂.
Erroneous Data: Guatemala (C.M.), 1 ♂.

Melinaea lilis messatis (Hewitson) Plate II, figure 36.

Mechanitis messatis Hewitson, 1855 (1852–1876), vol. 1, p. [18], pl. [9] Mechanitis, I, fig. 4; New Grenada.
Melinaea messatis, Kirby, 1871, p. 34. Hoppfer, 1874, p. 344. Haase, 1893, p. 52. Haensch, 1909, p. 124, pl. 33d. Fassl, 1912, p. 157. Forbes, 1927, pp. 24, 29. Bryk, 1937, p. 473. Fox, 1939, p. 73; 1940, p. 179. Forbes, 1948, p. 4.

The type, a female, should be in the British Museum (Natural History) but cannot be located; the subspecies is quite recognizable from Hewitson's figure.

It differs from *parallelis* principally in that the black postmedian band of the hind wing is reduced proximad, especially on the upper side, and in some cases is almost entirely missing.

Specimens examined:

Colombia: Rio Minero near Muzo (A.M.N.H.), 2 ♂. Santa Cecilia,

Pueblo Rico, Department Caldas (A.M.N.H.), 2 ♂. Rio Opon, Department Boyaca (A.M.N.H.), 25 ♂, 4 ♀. Rio Suarez, Department Santandar (A.M.N.H.), 7 ♂, 2 ♀. Pico de Armas, Department Santandar (A.M.N.H., C.M.), 8 ♂, 4 ♀. Muzo (B.M.), 2 ♂, 3 ♀. Rio Chili (B.M.), 2 ♀. Cananche, Department Cundinamarca (B.M.), 4 ♂, 4 ♀. El Santerio, Department Tolima (B.M.), 1 ♀. Santa Fe de Bogota (B.M.), 2 ♂, 1 ♀. Bogota (B.M., C.M., M.C.Z.), 11 ♂, 8 ♀. Bolivar (A.M.N.H.), 2 ♂. Carmen de Yacopi (C.M.), 1 ♀. Without locality (A.M.N.H.., B.M., C.M., M.C.Z.), 7 ♂, 8 ♀.

Ecuador (?): Without locality (B.M.), 3 ♀.

Peru: Northeastern [Bassler station F 6186, probably Rio Putumayo] (A.M.N.H.), 1 ♂, 5 ♀. Without locality (M.C.Z.), 1 ♂.

No Data: (A.M.N.H., M.C.Z.), 2 ♂, 2. ♀

Erroneous Data: Brazil (C.M.), 1 ♀. Bolivia (B.M.), 1 ♀.

Melinaea lilis erica Bargmann

Melinaea imitata lilis erica Bargmann, 1929, p. 33; Rio Dagua, Colombia. Bryk, 1937, p. 473. Fox, 1940, p. 179. Forbes, 1948, pp. 2–5.

This is a yellow-spotted subspecies that has lost the proximal part of the black hindmarginal bar of the forewing but has retained the white paired marginal dots, thus combining some of the features of the white-spotted subspecies.

Specimens examined:

Colombia: Rio Dagua [Pacific drainage] (B.M.), 1 ♂, 1 ♀. Juntas, Department Cauca (B.M.), 1 ♂, 1 ♀. (This pair is intermediate between *erica* and *messatis*.)

Melinaea lilis dodona Hopffer

Melinaea dodona Hopffer, 1874, p. 344; Bolivia; 1879, pp. 420–421. Forbes, 1927, pp. 24, 29. Bryk, 1937, p. 472. Fox, 1939, p. 74; 1940, p. 179. Forbes, 1948, pp. 3, 4.

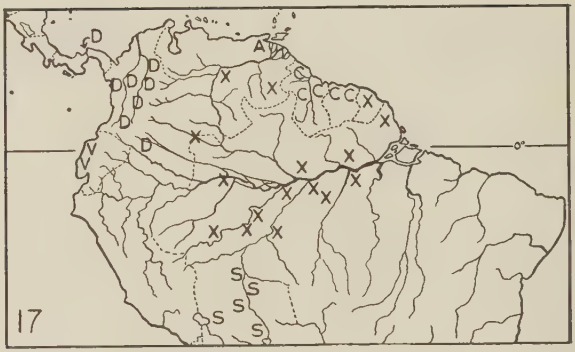
The type is in the Berlin Museum.

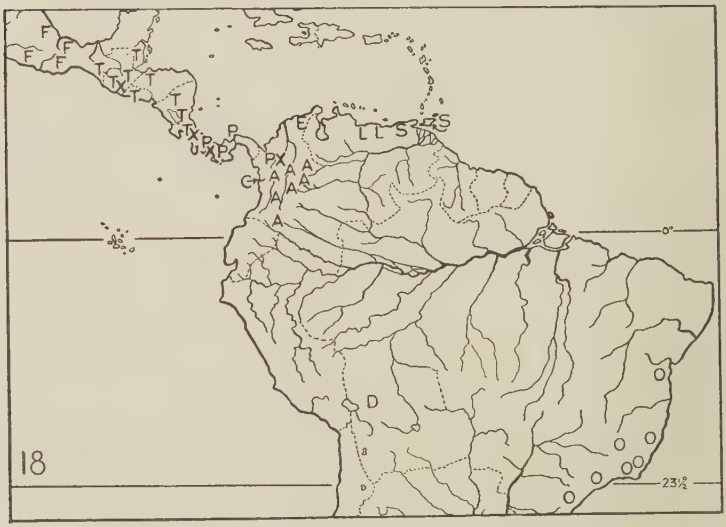
The forewing postmedian fascia is broken into separate spots, as in the white-spotted forms, but the hind marginal bar is complete. The paired white marginal dots are prominent. This seems to represent another structural link between the white- and yellow-spotted subspecies.

Melinaea ethra (Latreille) Plate II, figure 37.

Heliconia ethra Latreille, 1820 (1819–1823), pp. 201, 221–222; Brazil.

Melinaea ethra, Doubleday, 1847 (1846–1852), p. 104. Kirby, 1871, p. 642. Burmeister, 1878, p. 123; 1879, p. 16. Haase, 1893, p. 51. Sanders,





Figs. 17 and 18. Fig. 17—Distribution of *Melinaea mneme, M. idae,* and *M. satevis.* Symbols: A, *M. s. aurantia;* C, *M. s. crameri* and *M. mneme* (*c.f.* symbol X); D, *M. i. idae;* S, *M. s. satevis;* V, *M. i. vespertina;* X, *M. mneme* only. Fig. 18—Distribution of *Melinaea lilis, M. ethra,* and *M. scylax.* Symbols: A, *M. l. messatis;* C, *M. l. erica;* D, *M. l. dodana;* E, *M. l. ezra;* F, *M. l. flavicans;* L, *M. l. lilis;* O, *M. ethra;* P, *M. l. parallelis;* S, *M. l. sola;* T, *M. l. imitata;* X, *M. scylax.*

1904, p. 323. Moulton, 1909, p. 591. Haensch, 1909, p. 123, pl. 33d. Seitz, 1910, p. 167. Kohler, 1923, p. (18). Kremky, 1925, pp. 195, 196, 199, 271, figs. 46, 48, 52, pl. 22, fig. 3. Forbes, 1927, pp. 24, 27, 29, pl. 3. Bryk, 1937, pp. 471–472. Fox, 1940, p. 179.

This easily recognized species comes from southeastern Brazil (fig. 18). The paired marginal spots are present on the under side, the hindmarginal bar of the forewing is complete, the comma mark is elongated and club-like. The subapical elements of the forewing are fused into a large yellow spot, the yellow postmedian fascia is wide and the disc of the hind wing is bright yellow. Probably *ethra* is related to the *lilis* stock in much the same way that *scylax* is. The genitalia stand between those of *lilis* and *scylax*.

Specimens examined:

Brazil: Canta Gallo (M.C.Z.), 2 ♂, 1 ♀. Gavea (A.M.N.H.), 1 ♂, 1 ♀. Corcovado (A.M.N.H.), 1 ♂. Rio de Janeiro (B.M.), 3 ♂, 3 ♀. Bahia (B.M.), 3 ♂, 3 ♀. Espirito Santo (B.M.), 3 ♂. Nova Friburga (B.M.), 1 ♂, 1 ♀. Cachimbo, Bahia (B.M.), 1 ♀. Guaruja, Espirito Santos (B.M.), 1 ♂. Itabapoana, Rio de Janeiro (B.M.), 2 ♂. Petropolis (B.M.), 1 ♀. Minas Geraes (B.M.), 3 ♂. São Paulo (B.M.), 1 ♂. Santa Catharina (A.M.N.H.), 1 ♀. Without locality: (B.M., M.C.Z.), 2 ♂.

No Data: (B.M.), 1 ♀.

Erroneous Data: Amazon River (M.C.Z.), 1 ♂.

Melinaea scylax Salvin Plate II, figure 38.

Melinaea scylax Salvin, 1871, p. 412; Veraguas, Costa Rica. Kirby, 1877, p. 697. Butler and Druce, 1874, p. 335. Godman and Salvin, 1879 (1879–1901), p. 13, pl. 2, fig. 12. Staudinger, 1885 (1884–1888), p. 71. Haase, 1893, p. 53. Berg, 1897, p. 235. Godman, 1901 (*in* Godman and Salvin, 1879–1901), p. 641. Weymer, 1907, p. 4. Haensch, 1909, p. 123, pl. 33c. Riley and Gabriel, 1925, p. 44. Forbes, 1927, pp. 24, 27, 29. Bryk, 1937, pp. 481–482. Fox, 1939, p. 73; 1940, p. 179.

Melinaea ribbei Weymer, 1875, pp. 379–380; pl. 2, fig. 4. Staudinger, 1875, pp. 97–98. Haensch, 1909, p. 123. Bryk, 1937, p. 482.

The type is a male from Veraguas mountains, Panama, number 6973 in the British Museum (Natural History).

The black postmedian band is wanting on the hind wing, though sometimes is suggested on the under side. The forewing has the hindmarginal bar reduced proximad. Otherwise *scylax* look much like a *lilis* form. Forbes (1927) noted that it almost certainly is derived from the same stock. Its distribution (fig.

18) overlaps that of *l. imitata* to the north and of *l. messatis* to the south. This, plus the fact that the forewings are proportionately broader and the fact that the penis is proportionately 10%–25% shorter than in any *lilis* form, establishes *scylax* as a separate species.

Specimens examined:

Guatemala: (?) Without locality (A.M.N.H.), 1 ♂.

Costa Rica: San Mateo (C.M.), 1 ♀. Hacienda El Rodeo (C.M.), 1 ♂, 3 ♀. Pozo Azul (B.M.), 1 ♀. Without locality (B.M.), 5 ♂, 2 ♀.

Panama: Chiriqui (B.M., M.C.Z.), 11 ♂. Armuelles (A.M.N.H.), 1 ♂. Bugaba (B.M.), 2 ♂, 4 ♀. David (B.M.), 1 ♂. Toboga Island (B.M.), 1 ♂. Veraguas (B.M.), 1 ♀. Without locality (B.M.), 3 ♂, 1 ♀.

Colombia: Juntas, Rio Cauca (B.M.), 4 ♂. Without locality (A.M,N.H.), 1 ♂.

No Data: (C.M., M.C.Z.), 2 ♂.

Melinaea satevis (Doubleday and Hewitson)

There are three subspecies (fig. 17), *satevis* of Bolivia, *crameri* of the Guianas and *aurantia* of the lower Orinoco River. Some confusion was created by Cramer's misidentification of *mneme* Johansson, an error in which he was followed by Weymer (1890), Haensch (1909), and Forbes (1927) among others. Godman and Salvin's note (1898) and Kaye's exposition (1925) should have cleared up the matter.

satevis differs from true *mneme* in that the hindmarginal bar of the forewing is virtually absent instead of being strong, and the spots of the forewing discal cell are separate and round, while in *mneme* they are confluent and the anterior one is an elongated triangle. In *satevis* the foramen of the penis is longer than the saccus, but in *mneme* it is shorter. These two species have not been confused biologically; it has been a matter of improper application of names.

Melinaea satevis satevis (Doubleday and Hewitson) Plate II, figure 39.

Mechanitis satevis Doubleday and Hewitson, 1847 (1846–1852), p. 130, pl. 17, fig. 31; Bolivia. Riley and Gabriel, 1925, p. 44.

Melinaea satevis, Kirby, 1871, p. 34. Hopffer, 1879, p. 421. Haensch, 1909, p. 123, pl. 33b. Forbes, 1927, p. 30. Bryk, 1937, p. 481. Fox, 1940, p. 179.

The type is a female numbered 6974 in the British Museum (Natural History).

The peculiar faded mahogany ground color is distinctive. It also differs from *crameri* in that the postmedian band of the hind wing is entirely missing. The excellent series in the Carnegie Museum comes from the lowlands of northeastern Bolivia.

Specimens examined:

BOLIVIA: Rio Yapacani (C.M.), 6 ♂, 11 ♀. Rio Surutu (C.M.), 1 ♀. Buenavista (C.M.), 3 ♂, 1 ♀. Provinca del Sara (C.M.), 9 ♂, 1 ♀. San Mateo (B.M.), 2 ♂. Rio Mapiri (B.M.), 2 ♂, 1 ♀. Yoyo (B.M.), 1 ♀. Cervico (B.M.), 1 ♀. Farinas (B.M.), 1 ♀. Corico (B.M.), 1 ♀. Without locality (B.M., M.C.Z.), 5 ♂, 4 ♀.

Melinaea satevis crameri Godman and Salvin Plate II, figure 40.

Melinaea crameri Godman and Salvin, 1898, p. 107. Poulton, 1903, pp. liv, lv. Kaye, 1907, pp. 413–419, 422, 430, 432–433, 434, pl. 23, fig. 6, pl. 24, fig. 5, pl. 25, fig. 5. Riley and Gabriel, 1925, pp. 14–15.
Papilio mneme, Cramer (not Johansson), 1779 (1775–1791), pl. 190, fig. C. Herbst 1790, p. 115, pl. 69, fig. 7.
Eueides mneme, Hübner, 1816 (1816–1827), p. 11.
Melinaea mneme, Bates, 1862, p. 550. Staudinger, 1885 (1884–1888), p. 71. Weymer, 1890, pp. 282–283. Haase, 1893, pp. 51, 53. Haensch, 1909, p. 123, pl. 33a. Forbes, 1927, pp. 24, 26, 30. Bryk, 1937, pp. 480–481 (part). Fox, 1940, p. 179. Forbes, 1942, pp. 27–28.
Melinaea crameri incisa Kaye, 1925b, p. xxiii.

The types of *crameri* are in the Birtish Museum (Natural History), as are the types of aberration *incisa.*

The hind wing is covered by a large black patch which includes the discal cell and leaves only the extreme base of the wing and a double submarginal patch between M_1 and M_3 tawny.

Specimens examined:

BRITISH GUIANA: Kartabo Woods (C.M.), 4 ♂, 1 ♀. Demerara River (B.M., C.M., M.C.Z.), 4 ♀. Wismar, Demerara River (A.M.N.H.), 4 ♂, 1 ♀. Kartabo (A.M.N.H.), 11 ♂. Maripa (A.M.N.H.), 1 ♂. Bartica (A.M.N.H.), 3 ♂, 1 ♀. Kuruhung (A.M.N.H.), 2 ♂. Kamakusa (A.M.N.H.), 1 ♀. Rockstone, Essequibo River (A.M.N.H.), 1 ♂. Azemu (A.M.N.H.), 1 ♂. Mabaruma (B.M.), 1 ♂. Creeklands (A.M.N.H.), 1 ♂. Roraima (B.M.), 2 ♂, 2 ♀. Without locality (B.M., C.M.), 9 ♂, 7 ♀.

DUTCH GUIANA: Without locality (B.M.), 1 ♂.

DOUBTFUL DATA: Colombia (B.M., "cotype"), 1 ♂.

Melinaea satevis aurantia Forbes

Melinaea mneme aurantia Forbes, 1942, pp. 27, 28; Caripito, Monagas, Venezuela; 1948, pp. 2, 24, pl. 1, fig. 3.

The type is in the Cornell University collection. This attractive subspecies was a most interesting find.

Specimens examined:

VENEZUELA: Caripito, Monagas (C.U., A.M.N.H.), 7 specimens.
COLOMBIA: Without locality (probably not Colombia) (U.S.N.M.), 2 ♂.

Melinaea idae (Felder and Felder)

This species has a pattern highly modified, deviating from the usual *Melinaea* appearance, but evidently it is a derivation from the *satevis* line. There are two subspecies (fig. 17): *i. idae* is found from Panama to Peru east of the Andean uplift, *i. vespertina* is from western Ecuador.

Melinaea idae idae (Felder and Felder) Plate III, figure 41.

Mechanitis idae Felder and Felder, 1862, p. 414; Bogotá, Colombia; 1865 (1864–1867), p. 355, pl. 2, fig. 45.
Melinaea idae, Kirby, 1871, p. 34. Hopffer, 1879, p. 420. Staudinger, 1885 (1884–1888), p. 71. Weymer, 1890, p. 12. Haensch, 1903, p. 163; 1909, p. 124, pl. 33c. Fassl, 1912, p. 157. Forbes, 1927, pp. 24, 28, 30. Bryk, 1937, p. 472. Fox, 1940, p. 179; 1945, p. 1.

The types are in the Tring collection at the British Museum (Natural History).

This is distinguished from *vespertina* by having the wide marginal black of the hind wing fading gradually into the discal tawny.

Specimens examined:

PANAMA: Barro Colorado Island (A.M.N.H., C.M., M.C.Z.), 9 ♂, 11 ♀. Corozol (A.M.N.H.), 1 ♂. Fort Sherman (A.M.N.H.), 2 ♀. Rio Trinidad (A.M.N.H.), 2 ♂. Juan Mina (A.M.N.H.), 1 ♂. Matachin (B.M.), 2 ♂. Canal Zone (A.M.N.H., M.C.Z.), 2 ♂.

COLOMBIA: Canarche, Department Cundinamarca (B.M.), 1 ♀. El Sanapani, Department Tolima (B.M.), 1 ♂. Pico de Armas, Department Santander (A.M.N.H.), 6 ♂. Rio Suarez, Department Santander (A.M.N.H., C.M.), 5 ♂. Rio Opon, Department Boyacá (A.M.N.H.), 11 ♂, 2 ♀. Rio Minero near Muzo (A.M.N.H.), 4 ♂. Pizzaro, Department Choco at sea level (A.M.N.H., C.M.), 3 ♂. Muzo (B.M.), 8 ♂,

1 ♀. Cauca valley (A.M.N.H.), 1 ♂. Tomeque (C.M.), 1 ♀. Bogotá (B.M., C.M., M.C.Z.), 9 ♂, 2 ♀. Without locality (A.M.N.H., B.M., C.M.), 7 ♂, 2 ♀.

PERU: Northeastern [Bassler station F 6186, probably Rio Putumayo] (A.M.N.H.), 7 ♂.

NO DATA: (M.C.Z.), 2 ♂.

ERRONEOUS DATA: Bolivia (B.M.), 1 ♂.

Melinaea idae vespertina Fox Plate III, figure 42.

Melinaea idae vespertina Fox, 1945, pp. 1–2, fig. 21; western Ecuador.

The type series consisted of 103 specimens from the Departments of Los Rios, Pinchincha, Manabi, and Chimborazo, all in Western Ecuador, and was distributed to various collections; the holotype is in the American Museum of Natural History.

The black border of the hind wing is narrower than in *idae* and its inner edge is sharp and clean.

Specimens examined:

ECUADOR: Playas de Montivalo, Los Rios (A.M.N.H., A.N.S.P., C.M., C.U., I.O.C., M.C.Z., R.P.M., U.S.N.M.), 56 ♂, 16 ♀. Santa Ana Maria, Los Rios (B.M.), 1 ♂. Santa Domingo, Pichincha (A.M.N.H., R.P.M.), 6 ♂, 1 ♀. Palmar, Manabi (A.M.N.H., C.M., R.P.M.), 12 ♂, 6 ♀. Cojimes, Manabi (C.M.), 1 ♂. Balzabamba, Bolívar (A.M.N.H.), 2 ♂, 2 ♀. La Chima, Bolívar (B.M.), 1 ♂, 1 ♀. Huigra, Chimborazo (A.N.S.P.), 2 ♂. Chimbo, Chimborazo (B.M.), 3 ♂. Hacienda Cutugany, Guayas (A.N.S.P.), 1 ♂. Ventura, Guayas (M.C.Z.), 1 ♂. Rio Salinas, Esmeraldas (C.M.), 3 ♂. Rio Agua Clara, Esmeraldas (C.M.), 3 ♂. Cachabe, Esmeraldas (B.M.), 2 ♂. La Guayacana, Narino (A.M.N.H.), 9 ♀. Guayaquil (B.M.), 1 ♂. Saruma, El Oro (B.M.), 2 ♀. Without locality (B.M., M.C.Z.), 3 ♂.

ERRONEOUS DATA: Bogotá, Colombia (B.M.), 1 ♂. Oriente Ecuador (M.C.Z.), 1 ♀. Panama [Voyage H.M.S. Harold] (B.M.), 3 ♂. Matachin, Panama (B.M.), 1 ♀.

Melinaea egina (Cramer)

Four subspecies now are known (fig. 19): *egina* from the Guianas south to Para and up the Amazon river, including tributaries, as far as the Rio Purus; *paraiya* found through tropical southeastern and southern Brazil; *manuelito* from central Peru. The fourth subspecies, *agricola*, is known only from the holotype which bears a label from Ega, Brazil. If this locality is correct *agricola* would seem to be an aberration of *e. egina*. Hall's name is treated here as a valid subspecies because the pattern is so

distinctive and the insect does not have the usual features of an aberration, and further because "Ega" is a traditional generalized locality. Future collecting will no doubt establish the true range of *agricola,* but in any event it belongs with *egina.*

Melinaea egina egina (Cramer) Plate III, figure 43.

Papilio egina Cramer, 1777 (1775–1791), p. 114, fig. 191 D; Surinam. Herbst, 1790, pp. 111–112, pl. 69, fig. 4. Fabricius, 1793, p. 162. Latreille, 1820 (1819–1823), p. 216, pl. 20, fig. 2.

Mechanitis egina, Doubleday, 1847 (1846–1852), p. 130.

Melinaea egina, Bates, 1862, p. 550. Butler, 1869, p. 124. Kirby, 1871, pp. 33–34. Butler, 1877, p. 110. Burmeister, 1878, p. 123. Schatz, 1885 (1884–1888), p. 10, fig. d. Reuter, 1896, pp. 37–38, fig. 16. Poulton, 1903, p. liv. Sanders, 1904, p. 323. Poulton, 1907, p. lxi. Kaye, 1907, pp. 413–416, 419, 430, 432–433, pl. 23, fig. 5. Haensch, 1909, p. 124. Forbes, 1927, p. 28. Bryk, 1937, pp. 470–471. Fox, 1940, p. 179. Forbes, 1948, p. 5. Bryk, 1953, p. 28.

Papilio ludivica Cramer, 1779 (1775–1791), vol. 3, p. 17; 1780 (*op. cit.*), pl. 297, fig. E; Surinam. Bryk, 1937, p. 471.

The western boundary of the distribution is suggested by locality records at hand from Rio Corona, Bolívar, Venezuela, from Rio Caqueta in the Amazons of Colombia, from Rio Huallaga, Peru and Rio Purús, Brazil. All these specimens agree with those from Guiana and Para.

Specimens examined:

British Guiana: Carimang River (B.M.), 2 ♂. Annai, Essequibo River (B.M.), 1 ♂. Between Chenapowu and Savaritik (A.M.N.H.), 1 ♂. Kangaruma (A.M.N.H.), 7 ♂. Puruima (C.M.), 1 ♂. Without locality (B.M.), 2 ♂.

Dutch Guiana: Without locality (A.M.N.H., B.M., M.C.Z.), 4 ♂, 2 ♀.

French Guiana: St. Laurent, Maroni River (B.M.), 2 ♂, 2 ♀. Berg-en-daal (B.M.), 1 ♂. Maroni River (A.M.N.H.), 2 ♂. Pied Saut, Oyapok River (C.M.), 6 ♂. Mana River (C.M.), 2 ♂. Without locality (A.M.N.H., B.M.), 8 ♂, 1 ♀.

Brazil: Obidos (B.M., C.M., Z.S.B.), 4 ♂. Itiatuba, Rio Tapajoz (B.M., M.C.Z., Z.S.B), 7 ♂, 3 ♀. Manicore, Rio Madeira (B.M.), 3 ♂. Santarem (B.M., C.M., M.C.Z.), 7 ♂, 2 ♀. Benevides, Para (C.M.), 11 ♂, 1 ♀. Oucatopi Island (C.M.), 1 ♂. Para (A.M.N.H., B.M., M.C.Z.), 13 ♂, 6 ♀. Sebastopol, Rio Purús (B.M.), 1 ♂. Hyatunahan, Rio Purús (C.M.), 1 ♂. Manacapuru (C.M.), 6 ♂, 4 ♀. Nova Olinda, Rio Purús (C.M.), 9 ♂. Manaos (M.C.Z., Z.S.B.), 1 ♂, 1 ♀. Teffé (B.M., C.M., M.C.Z., Z.S.B.), 15 ♂, 2 ♀. Solimoens, San Juan (B.M.), 1 ♂, 2 ♀. São Paulo de Olivença

(C.M.), 1 ♀. Rio Caiary-Uaupes (A.M.N.H.), 3 ♂, 2 ♀. Rio Uaupes (B.M.), 1 ♂. Maranham (B.M.), 2 ♂. Mt. Aureos, Maranham (B.M.), 2 ♂. East Amazons (A.M.N.H.), 1 ♀. Without locality (C.M.), 2 ♂.

VENEZUELA: Rio Suapure (M.C.Z.), 2 ♂.

COLOMBIA: Benjamin Constant, Amazonas (A.M.N.H.), 1 ♂. Isla da Ronda, Amazonas (A.M.N.H., C.M.), 9 ♂, 1 ♀. Rio Tacana (A.M.N.H.), 23 ♂, 4 ♀. Cauacaya Putumayo (A.M.N.H.), 4 ♂. Lower Rio Putumayo (A.M.N.H.), 7 ♂. Tarapaca, Amazonas (A.M.N.H.), 1 ♂. Rio Catuhe, Amazonas (A.M.N.H.), 1 ♂, 2 ♀. Without locality (B.M.), 1 ♂.

ECUADOR: Aguano (B.M.), 1 ♂.

PERU: Yahuas territory (B.M.), 1 ♂. Achinamiza, Rio Huallaga (A.M.N.H.), 5 ♂, 2 ♀. Iquitos (A.M.N.H.), 4 ♂.

NO DATA: (B.M., M.C.Z.), 2 ♂, 1 ♀.

Melinaea egina paraiya Reakirt Plate III, figure 44.

Melinaea paraiya Reakirt, 1866, p. 242; Rio Janeiro, Brazil. Kirby, 1871, p. 34. Sanders, 1904, p. 322. Haensch, 1909, p. 124, pl. 33c. Kremky, 1925, pp. 195, 198, fig. 47. Forbes, 1927, p. 28. Tessmann, 1928, p. 119. Bryk, 1937, p. 471. Fox, 1940, p. 179. Forbes, 1948, p. 5.

This subspecies is not to be found in the Guianas and the Amazon as Haensch (1909) stated, but comes from the eastern and southern " bulge " of Brazil. If there are intergrading specimens between this and *e. egina,* I have never seen them.

Specimens examined:

BRAZIL: Rio de Janeiro (B.M., M.C.Z.), 5 ♂, 4 ♀. Corcovado (M.C.Z.), 3 ♂, 1 ♀. Rio Tijuco (B.M.), 1 ♂. Nova Friburgo (B.M.), 1 ♂. Itabapaona (B.M.), 1 ♂, 1 ♀. Canto Gallo (A.M.N.H.), 1 ♂, 2 ♀. Minas Geraes (B.M.), 2 ♂. Pernambuco (M.C.Z.), 1 ♀. Espirito Santo (B.M.), 1 ♀. Guaruja, Santos (B.M.), 2 ♂, 1 ♀. Para (B.M., Hewitson collection), 1 ♂. Without locality (M.C.Z.), 2 ♂.

NO DATA: (B.M., M.C.Z.), 2 ♂, 1 ♀.

ERRONEOUS DATA: Guiana (M.C.Z.), 1 ♂. Bogotá (C.M.), 1 ♂. Peru: Cavallo, Cochobamba (B.M.), 1 ♂.

Melinaea egina manuelito Tessmann

Melinaea egina manuelito Tessmann, 1928, p. 119, pl. 5, fig. 22; Pozuzotal and Santa Nicolas, Puchalini. Bryk, 1937, p. 478. Forbes, 1948, p. 5.

The type is in the Berlin Museum. The localities cited in the original description are from central Peru, but I have not so far seen specimens. Tessmann's figure is quite adequate.

Melinaea egina agricola Hall

Melinaea agricola Hall, 1935, p. 227, pl. 6, fig. 6; Ega, Amazons. Bryk, 1937, p. 470. Fox, 1940, p. 179. Forbes, 1942, p. 28; 1948, p. 2.

The holotype is a male in the British Museum (Natural History).

Forbes (1948) associated this with *crameri,* but it lacks the spot in the anal angle of the forewing. Inspection of the type convinced me that this is a form of *egina.* If the type locality is correct *agricola* probably is an aberration of *e. egina,* as Ega is well within its known distribution. However, Ega was often cited as the locality by travellers who purchased specimens there, the insects themselves having been captured perhaps hundreds of miles away. My guess, and it is frankly that, is that *agricola* does not come from Ega at all and that it is a good subspecies.

Specimens examined:

Brazil: Ega (B.M.), 1 ♂ (locality doubtful).

Melinaea mnemopsis Berg Plate III, figure 45.

Melinaea mnemopsis Berg, 1897, p. 235; Peru. Haensch, 1909, p. 123, pl. 33d. Forbes, 1927, pp. 24, 27, 29. Bryk, 1937, p. 481. Fox, 1940, p. 179.

Melinaea boliviana Weymer, 1907, pp. 2–4, pl. 1, fig. 2; Bolivia. Haensch, 1909, p. 123. Bryk, 1937, p. 481.

The type is in the Natural Science Musuem of Buenos Aires.

This distinctive species stands quite apart from anything else in the genus, but in a general way shows a relationship with *satevis.* It is found in the lower valleys of northeastern Bolivia (fig. 20).

Specimens examined:

Bolivia: Province del Sara (C.M.), 22 ♂, 13 ♀. Buenavista (C.M.), 3 ♂, 1 ♀. Rio Yapacani (C.M.), 1 ♂, 2 ♀. Rio Surutu (C.M.), 1 ♂, 1 ♀. Portachuelo (C.M.), 1 ♂. Las Juntas (C.M.), 2 ♀. Santa Cruz del Sara (B.M., C.M.), 1 ♂, 2 ♀. Torochito (B.M.), 2 ♂, 2 ♀. Rio Mapiti (B.M.), 1 ♂. Without locality (B.M., C.M.), 3 ♂, 1 ♀.

No Data: (B.M.), 1 ♂.

Melinaea maelus (Hewitson)

This species shows a close relationship to *M. mneme.* The paired marginal spots are never present, however, except in a

few individuals where the erstwhile black rings around the white spots are retained as tiny black dots (fig. 13). The six subspecies are distributed (fig. 20) as follows: *m. madeira* comes from the valley of the Rio Madeira; *purusana* is found in the middle reaches of the Rio Purús; *brunnea* is from the upper Rio Purús and probably could be collected in Bolivia; *mayi* is the subspecies from the Rio Jurua. On the Amazon itself, *maelus* is found above Teffé and up the Rio Putumayo into southeastern Colombia, while *cydon* comes from the Marañon above Iquitos, including the valleys of the Huallaga and the Ucayali.

Melinaea maelus madeira Moulton Plate III, figure 46.

Melinaea pardalis, Butler (not Bates), 1877, p. 110.
Melinaea pardalis madeira Moulton, 1909, pp. 597, 604–606, pl. 32, fig. 2; Manicore, Rio Madeira. Haensch, 1909, p. 123, pl. 33b. Riley, 1919, p. 182. Forbes, 1927, pp. 24, 32. Bryk, 1937, p. 475. Fox, 1940, p. 179. Forbes, 1948, p. 2. d'Almeida, 1951, pp. 18, 26.

Of the types, two females from "Amazons" are in the Hope Department, Oxford University, and a male and female from Manicore, Rio Madeira, are in the British Museum (Natural History).

d'Almeida (1951) stated that this is the same form named *purusana* by Riley (1919). After comparing material in the British Museum (Natural History) recently, I can state that the two are definitely different subspecies. The pattern differences used in the key are consistent for the good series of both that I have seen.

Specimens examined:

Brazil: Manicore, Rio Madeira (B.M.), 6 ♂, 5 ♀. Capana Lake, Lower Rio Madeira (B.M.), 1 ♂. Santa Maria (B.M.), 1 ♂. Lower Rio Madeira (B.M.), 4 ♂, 5 ♀. Without locality (B.M., M.C.Z., Z.S.B.), 4 ♂, 2 ♀.

Melinaea maelus purusana Riley Plate III, figure 47.

Melinaea hicetas purusana Riley, 1919, p. 181; Allianca, Rio Purús. Riley and Gabriel, 1925, p. 42. Bryk, 1937, p. 478. Fox, 1943, p. 397, pl. 1, fig. 1. Forbes, 1948, p. 2. d'Almeida, 1951, pp. 18, 26.
Melinaea madeira purusana Aurivillius, 1929, p. 155; Hyatanahan, Rio Purús. Bryk, 1937, p. 475. Fox, 1940, p. 179; 1943, p. 397. Forbes, 1948, p. 2. d'Almeida, 1951, pp. 18, 26.
Melinaea maelus romani Bryk, 1937, p. 641. d'Almeida, 1951, p. 26.

The series in the Carnegie Museum is topotypic with the Aurivillius type series and exactly agrees with the Riley types, a male and a female from Alliance, Rio Purús, numbered 81 and 82 in the British Museum (Natural History). The Aurivillius name (published posthumously) is both a homonym and an absolute synonym, as pointed out previously (Fox, 1943). The Bryk name was proposed as a substitute for *purusana* Aurivillius to avoid homonymy, but was not necessary.

Specimens examined:

Brazil: Sebastopol, Labrea, Rio Purús (B.M.), 2 ♂, 1 ♀. Manaos (B.M.), 1 ♂, 1 ♀. Allianca, Rio Purús (B.M.), 1 ♂. Hyatanahan, Rio Purús (C.M.), 10 ♂. Nova Olinda, Rio Purús (C.M.), 12 ♂. Manacapuru (C.M.), 1 ♂. Rio Purús (Z.S.B.), 1 ♂.

Melinaea maelus brunnea Riley Plate III, figure 48.

Melinaea hicetas brunnea Riley, 1919, p. 181; Bocca de Acre, Rio Purús. Riley and Gabriel, 1925, p. 10. Bryk, 1937, p. 477. d'Almeida, 1951, p. 26.

The type is in the British Museum (Natural History), a female numbered 80, from Bocca de Acre, Rio Purús. This subspecies is found some three or four hundred kilometers further up the Rio Purús and is quite different from *purusana,* having the postmedian fascia of the forewing tawny, while in *purusana* the fascia is clear yellow.

Specimen examined:

Brazil: Bocca de Acre, Upper Rio Purús (B.M.), 1 ♀.

Melinaea maelus mayi d'Almeida

Melinaea mayi d'Almeida, 1951, pp. 20–22, pl. 4, fig. 1; Upper Rio Jurua, Acre, Brazil.

The holotype is in the Museu Nacional, Rio de Janeiro, numbered 13,768. This is the Rio Jurua subspecies of *maelus.*

Specimens examined:

Brazil: Porto Walter, Upper Rio Jurua (A.M.N.H.), 2 ♂.

Melinaea maelus cydon Godman and Salvin Plate III, figure 49.

Melinaea pardalis, Druce (not Bates), 1876, p. 211.
Melinaea cydon Godman and Salvin, 1879, p. 151; Tabatinga, Pebas, Iquitos, Peru. Haensch, 1909, p. 123, pl. 33b. Riley and Gabriel,

1925, p. 15. Forbes, 1927, pp.. 24, 32. Bryk, 1937, p. 474. Fox, 1940, p. 179. d'Almeida, 1951, p. 26.

The types are in the British Museum (Natural History), numbered 7013–1719, five males and two females from Peru. The distribution includes northeastern Peru along the Marañon as far down river as Iquitos, and up into the Huallaga and Ucayali valleys.

Specimens examined:

Colombia: Rio Salinaes, Amazonas (A.M.N.H.), 1 ♀. Benjamin Constant, Amazonas (A.M.N.H.), 2 ♂, 3 ♀. Isla de Ronda, Amazonas (A.M.N.H., C.M.), 11 ♂, 6 ♀. Tarapaca, Amazonas (A.M.N.H.), 1 ♀. Rio Cotuhe, Amazonas (A.M.N.H., C.M.), 6 ♀. Rio Tacana, Amazonas (A.M.N.H.), 2 ♂, 1 ♀. Loretoyacu, Amazonas (A.M.N.H.), 1 ♂. Lower Rio Putumayo, Amazonas (A.M.N.H.), 1 ♂, 1 ♀.

Peru: Pucallpa (A.M.N.H., Z.S.B.), 2 ♂. Rio Ucayali (A.M.N.H., B.M.), 2 ♂, 2 ♀. Rio Pacaya, Rio Ucayali (B.M.), 1 ♀. Achinamiza, Rio Huallaga (A.M.N.H.), 2 ♂, 1 ♀. Rio Huallaga (B.M.), 1 ♂. Rio Tapiche (A.M.N.H.), 1 ♂. Iquitos (A.M.N.H., B.M.), 3 ♂, 2 ♀. Chambireyacu (B.M.), 6 ♂, 3 ♀. Rio Marañon (A.M.N.H., B.M.), 1 ♂, 2 ♀. Pebas, Loreto (B.M.), 4 ♂. Rio Santiago (A.M.N.H.), 1 ♀.

Bolivia: Cavallo, Cochabamba (B.M.), 5 ♂, 6 ♀.

Brazil: Tabatinga (B.M.), 1 ♂, 1 ♀. São Paulo de Olivençia (B.M.), 4 ♀. Ega (Z.S.B.), 1 ♂. Manaos (Z.S.B.), 1 ♂. Without locality (C.M., M.C.Z.), 1 ♂, 2 ♀.

Melinaea maelus maelus (Hewitson) Plate III, figure 50.

Mechanitis maelus Hewitson, 1860 (1852–1876) (part), vol. 2, p [27], pl. [14] Mechanitis II, fig. 9 (not fig. 6); Amazons.

Melinaea maelus, Kirby, 1871, p 34. Haensch, 1903, p. 165; 1909, p. 123. Kremky, 1925, pp. 196, 197, 271, fig. 49, pl. 22, fig. 1. Forbes, 1927, pp. 23, 26, pl. 33. Bryk, 1937, p. 474. Fox, 1940, p. 179.

Melinaea pardalis Bates, 1862, p. 552; Ega (for Hewitson, *l.c.,* fig. 9). Bryk, 1937, p. 474.

The type of *maelus* should be in the British Museum (Natural History) but cannot be found. The types of *pardalis* are in the same collection, numbered 7020–7025, five males and a female from Ega.

Hewitson (1860) described *maelus* and cited figure 9 as illustrating the typical form, then went on to discuss a variation not separately named but illustrated as figure 6. Bates realized that the two figures were of different species, but created an absolute synonym by naming the type of *maelus* instead of the variety.

This subspecies is found on the upper Amazon river above Teffé and along the Rio Putumayo and Rio Caqueta in Colombia.

Specimens examined:

Brazil: Obidos (B.M.), 1 ♂. Teffé (B.M.), 12 ♂, 1 ♀. São Paulo de Olivença (B.M.), 2 ♂, 4 ♀. Rio Tonatins (B.M.), 1 ♂. Tabatinga (B.M.), 4 ♂. San Joas, Solimoes (B.M.), 1 ♀. San Felipe (B.M.), 3 ♂. Without locality (B.M., C.M.), 1 ♂, 2 ♀.

Colombia: Lower Rio Putumayo, Amazonas (A.M.N.H., C.M.), 9 ♂, 1 ♀. Isla de Ronda, Amazonas (A.M.N.H.), 1 ♂. Rio Tacana, Amazonas (A.M.N.H., C.M.), 4 ♂.

No Data: (C.M.), 2 ♂, 1 ♀.

Melinaea maeonis Hewitson

This species is the only one lacking the submarginal spots on both wings while retaining the spot in the anal angle of the forewing. The hindmarginal bar of the forewing is complete. The three subspecies are distributed (fig. 21) as follows: *borealis* is from western Venezuela, *maeonis* is found in southeastern Colombia and eastern Ecuador, *zamora* is from the Rio Ucayali in northeastern Peru.

Melinaea maeonis borealis Hall

Melinaea maelus zamora, Forbes (not Haensch), 1927 (part), p. 31.
Melinaea maeonis borealis Hall, 1935, p. 226; Mucuchachi, Venezuela. Bryk, 1937, p. 474. Fox, 1940, p. 179. Forbes, 1948, pp. 2, 3.

The type series in the British Museum (Natural History) consists of fourteen males and a female, all from the same locality. Mucuchachi is a small town on the southeastern slopes of the Merida range which separates the Lake Maracaibo drainage from the valley of the Rio Apure.

Specimens examined:

Venezuela: Muchuchachi (B.M.), 14 ♂, 1 ♀.

Melinaea maeonis maeonis Hewitson Plate III, figure 51.

Melinaea maeonis Hewitson, 1869 (1869–1877), p. 11; Ecuador. Kirby, 1871, p. 642. Haensch, 1903, p. 165; 1909, p. 123. Riley and Gabriel, 1925, p. 31. Forbes, 1927, p. 31. Bryk, 1937, p. 475. Fox, 1940, p. 179.
Melinaea strigilis Weymer, 1890, pp. 280–282; no locality. Bryk, 1937, p. 476. Forbes, 1948, p. 3.
Melinaea madeira aequatoriensis d'Almeida, 1951, pp. 23–24, pl. 5, fig. 1; Ecuador.

The type is a male from Ecuador in the British Museum (Natural History), number 7011. Weymer's *strigilis* is placed as an absolute synonym for *maeonis* only tentatively, since I have not seen the type nor any authentically named specimens; the description seems to match very closely. d'Almeida's *aequatoriensis* is an absolute synonym, the type of which is in the Museu Nacional, Rio de Janeiro, a male numbered 16,620.

Specimens examined:

COLOMBIA: Rio Ortegasa, Amazonas (A.M.N.H., C.M.), 3 ♂. Rio Caqueta (B.M.), 1 ♂.

ECUADOR: Canelos (A.M.N.H.), 1 ♀. Aguano (B.M.), 2 ♂. Frontera (B.M.), 1 ♀. Sarayacu (B.M.), 1 ♂, 2 ♀. Without locality (B.M.), 2 ♂, 3 ♀.

NO DATA: (B.M.), 1 ♀.

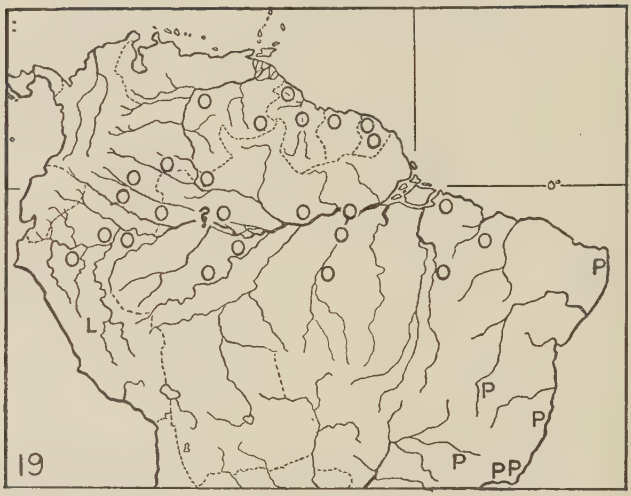
Melinaea maeonis zamora Haensch

Melinaea maeonis zamora Haensch, 1909, p. 123; Ucayali, Peru. Seitz, 1910, p. 171. Forbes, 1927, pp. 23, 31. Bryk, 1937, p. 475. Fox, 1940, p. 179. Forbes, 1948, p. 2.

The type is in the Berlin Museum. I have found no specimens in American collections or in the British Museum.

Melinaea marsaeus (Hewitson)

Three closely related species, *M. marsaeus*, *M. phasiana*, and *M. maenius*, form a compact complex within which it has been difficult to group the many geographic subspecies into their correct relationships. The hindmarginal bar of the forewing is almost always complete, and they lack the anal spot on the upper side. In many localities three different forms fly together, suggesting the existence of three species since local intergradation has not been observed. Of these, the forms subsumed as *M. marsaeus* retain on the under side of the forewing a tiny vestigial anal spot which is distinct in some individuals but is vestigial indeed in others; the discocellular spots are fused into a band; the anteapical elements are covered over with the black fascia. The five subspecies are distributed (fig. 24) as follows: *egesta* is from the Magdalena valley in Colombia, *marsaeus* itself is from the central Amazon basin from Obidos up to Teffé; *macaria* is found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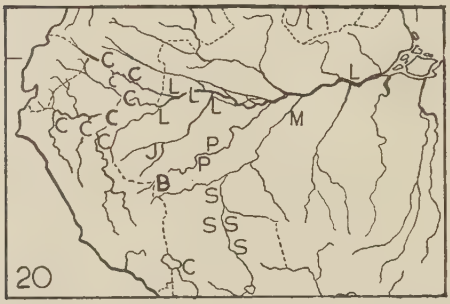
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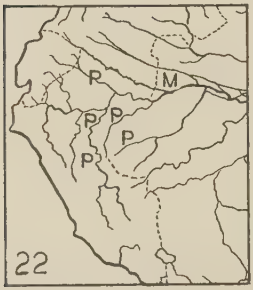
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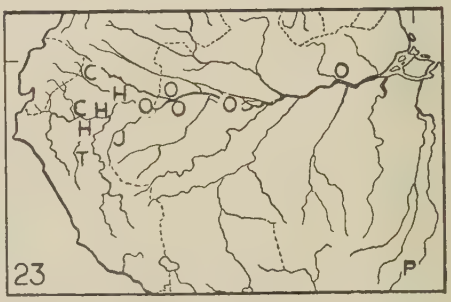
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from the Rio Meta in eastern Colombia to the Putumayo; *rileyi* comes from northeastern Peru and eastern Ecuador; *clara* is recorded from southern Peru and from the upper Rio Madeira in Brazil, suggesting that it may also be found in Bolivia.

Melinaea marsaeus egesta Godman and Salvin Plate IV, figure 62.

Melinaea egesta Godman and Salvin, 1898, p. 107. Riley and Gabriel, 1925, p. 17. Haensch, 1909, p. 122. Bryk, 1937, p. 477.

Although not inhabiting the same territory, this resembles *menophilus menophilus* very closely indeed and may be separated from it only by the presence on the forewing of a vestigial, unringed yellow anal spot, a pattern element found in most *marsaeus* but never present in *menophilus*. The holotype and allotype from "Interior of Colombia" are numbered 6993 and 6994 in the British Museum (Natural History); the two paratypes from Peru (6995, 6996) are aberration *flavosignata* of *m. menophilus*.

Specimens examined:

COLOMBIA: "Interior" (B.M.), 1 ♂, 1 ♀. Magdalena river valley (Munich), 1 ♂.

Melinaea marsaeus marsaeus (Hewitson)

Mechanitis marsaeus Hewitson, 1860 (1852–1876), vol. 2, p. [28], pl. [14] Mechanitis II, fig. 10; Amazon. Riley and Gabriel, 1925, p. 32.

Melinaea marsaeus, Haensch, 1909, p. 122. Forbes, 1927, pp. 24, 26, 32. Bryk, 1937, p. 475. Fox, 1940, p. 179. Forbes, 1948, pp. 2, 9.

Melinaea maelus, Bates (not Hewitson), 1862, p. 551. Kirby, 1871, p. 34.

The type is a male from "Amazon", number 7008 in the British Museum (Natural History). Bates' misidentification apparently suppressed the name until Haensch (1909) recognized its true status.

Figs. 19–23. Fig. 19—Distribution of *Melinaea egina*. Symbols: L, *M. e. manuelito;* O, *M. e. egina;* P, *M. e. paraiya;* ?, *M. e. agricola*. Fig. 20—Distribution of *Melinaea mnemopsis* and *M. maelus*. Symbols: B, *M. maelus brunnea;* C, *M. maelus cydon;* J, *M. maelus mayi;* L, *M. maelus maelus;* M, *M. maelus madeira;* P, *M. maelus purusana;* S, *M. mnemopsis*. Fig 21—Distribution of *Melinaea maeonis*. Symbols: B, *M. m. borealis;* O, *M. m. maeonis;* Z, *M. m. zamora*. Fig. 22—Distribution of *Melinaea phasiana*. Symbols: M, *M. p. manga;* P, *M. p. phasiana*. Fig. 23—Distribution of *Melinaea maenius*. Symbols: C, *M. m. cocana;* H, *M. m. hicetas;* J, *M. m. juruaensis;* O, *M. m. maenius;* P, *M. m. pothete;* T, *M. m. taropotensis*.

Specimens examined:

BRAZIL: Obidos (B.M.), 1 ♀. Teffé (B.M.), 11 ♂, 1 ♀. Amazons (B.M.), 1 ♀.

Melinaea marsaeus macaria Godman and Salvin Plate IV, figures 53, 54.

Melinaea macaria Godman and Salvin, 1898, pp. 107–108; St. Martin, Colombia. Haensch, 1909, p. 123. Riley and Gabriel, 1925, p. 31. Bryk, 1937, p. 477. Fox, 1940, p. 179; 1942, p. 1. Forbes, 1948, p. 3.

The types are in the British Museum (Natural History), three males and two females numbered 6988–6992, all from St. Martin, Colombia. This station probably is San Martino, a small town on a tributary of the upper Rio Guaviare in Meta Province. On the Rio Putumayo, this and *rileyi* meet and there is some slight intergradation between them, mainly in color deviations of the postmedial fascia. An aberrational specimen in the American Museum of Natural History lacks the subapical spots.

Specimens examined:

COLOMBIA: Rio Orteguaza, Rio Caquetá (A.M.N.H., C.M.), 43 ♂, 1 ♀. San Martin, Rio Meta (B.M.), 3 ♂, 3 ♀. Rio Caquetá (B.M.), 5 ♂. Villavicencio (B.M.), 1 ♀. Rio Putumayo (M.C.Z.), 1 ♂. Caucay Putumayo (A.M.N.H., C.M.), 46 ♂, 1 ♀. Without locality (A.M.N.H., B.M., M.C.Z.), 2 ♂, 4 ♀.

Melinaea marsaeus rileyi Fox Plate III, figure 52.

Melinaea lucifer, Staudinger (not Bates), 1885 (1884–1888), p. 71, pl. 30. Haensch, 1909, p. 122, pl. 33a. Forbes, 1927, pp. 24, 32. Bryk, 1937, p. 476. Fox, 1940, p. 179; 1942, pp. 1, 3.

Melinaea marsaeus rileyi Fox, 1942, p. 3; upper Rio Marañon, Peru. Forbes, 1948, pp. 2, 9.

The holotype and allotype are in the American Museum of Natural History and paratypes are in the Academy of Natural Sciences of Philadelphia, the Reading Public Museum, and the Cornell University collections. Staudinger (1885) mistook this not uncommon form for the very rare *lucifer* Bates and the error was repeated until the type of *lucifer* was studied.

Specimens examined:

COLOMBIA: Isla da Ronda, Amazonas (A.M.N.H.), 1 ♀. Loretayacu, Amazonas (A.M.N.H.), 1 ♀. Benjamin Constant, Amazonas (A.M.N.H., C.M.), 4 ♂, Rio Tacana, Amazonas (A.M.N.H.), 1 ♀. Caucaya Putumayo (A.M.N.H., C.M.), 2 ♂.

Ecuador: Sarayacu (B.M.), 1 ♀. Nauta (B.M.), 1 ♂.

Peru: Iquitos (B.M.), 1 ♂. Pebas (B.M., Z.S.B.), 5 ♂, 5 ♀. Rio Marañon (A.M.N.H., B.M.), 5 ♂, 2 ♀. Rio Huallaga (A.M.N.H., B.M.), 1 ♂, 1 ♀. Chambireyacu, Rio Huallaga (B.M.), 9 ♂, 4 ♀. Rio Santiago (A.M.N.H.), 1 ♀. Yahuas Territory (B.M.), 1 ♀. Rio Pacaya, Lower Rio Ucayali (B.M.), 1 ♀. Amazonas of Peru (B.M.), 4 ♂, 2 ♀. Yurimaguas (C.M., Z.S.B.), 1 ♂, 1 ♀. Without locality (C.M.), 1 ♂.

Brazil: São Paulo de Olivençia (B.M.), 1 ♂. Without locality (A.M.N.H.), 1 ♂.

No Data: (M.C.Z.), 2 ♂.

Melinaea marsaeus clara Rosenberg and Talbot Plate IV, figure 55.

Melinaea orestes clara Rosenberg and Talbot, 1914, p. 672, southeastern Peru. Forbes, 1927, p. 24; 1948, p. 6.

The type, a male from Yahuarmayo, Peru, number 6984 is in the British Museum (Natural History), and a paratype from the same station is in the main collection.

Specimens examined:

Peru: Rio Huacomayo, Carabaya (B.M.), 4 ♂. Yahuarmaya (B.M.), 1 ♂. Quincemil (A.M.N.H.), 1 ♂. Inca trail, Fort Union to Astillera (A.M.N.H.), 4 ♂.

Brazil: Falls above San Antonio, Rio Madeira (B.M.), 1 ♂, 1 ♀.

Melinaea phasiana Butler

Only two subspecies are known (fig. 22): *phasiana* is found in northeastern Peru on the Ucyali, Huallaga, and Marañon rivers, in Brazil on the Jurua, and in eastern Ecuador; *manga* comes from the vicinity of Teffé on the Amazon.

M. phasiana differs from the two closely related species, *M. maenius* and *M. marsaeus,* in that the forewing has the ante-apical and the apical part of the marginal elements present. In *M. p. phasiana* these are fused into a large apical patch, while in *manga* they are separate; in both, the black stripe separating the postmedian fascia from the nearest pale coloring in the apex is quite narrow. In both *maenius* and *marsaeus* the apex is either wholly black or only the subapical series is present, separated from the postmedian fascia by a wide black band.

Melinaea phasiana manga Haensch

Mechanitis maelus (part) Hewitson, 1869 (1852–1876), vol. 2, p. [27], pl. [14] Mechanitis II, fig. 6; Amazon. Butler, 1877, p. 110.

Melinaea manga Haensch, 1909, p. 123 (for Hewitson, *l.c.*). Forbes, 1927, pp. 24, 32. Bryk, 1937, p. 475. Fox, 1940, p. 149.

Although not noted by Riley and Gabriel (1925), the type is in the British Museum (Natural History) where I found it pinned with two females from Teffé in the main collection.

Specimens examined:

Brazil: Teffé (B.M.), 2 ♀. Amazon (B.M.), 1 ♀.

Melinaea phasiana phasiana Butler Plate IV, figure 56.

Melinaea phasiana Butler, 1870, p. 489; upper Amazon. Kirby, 1871, p. 642. Druce, 1876, p. 211. Hopffer, 1879, p. 421. Haensch, 1905, p. 146. Moulton, 1909, p. 598. Haensch, 1909, p. 123, pl. 33a. Riley and Gabriel, 1925, p. 38. Forbes, 1927, pp. 24, 32. Bryk, 1937, p. 476. Fox, 1940, p. 179. Bryk, 1953, p. 27.

Melinaea lucifer divisa Staudinger, 1885 (1884–1888), p. 71. Haensch, 1909, p. 122. Forbes, 1927, pp. 24, 32. Bryk, 1937, p. 476. Fox, 1940, p. 179.

Melinaea acraena d'Almeida, 1951, pp. 22, 23; pl. 4, fig. 2.

The type of *phasiana* is a female in the British Museum (Natural History) numbered 7012, from "Peruvian Amazons". The type of *divisa* is in the Berlin Museum. The types of *acraena* are two males and a female in the Museu Nacional, Rio de Janeiro, and a male in the collection d'Almeida, all from the upper Rio Jurua.

Specimens examined:

Ecuador: Rio Napo (B.M.), 1 ♂.

Peru: Pucallpa (A.M.N.H., C.M.), 3 ♂. Rio Ucayali (A.M.N.H., B.M.), 7 ♂. Achinamiza, Rio Huallaga (A.M.N.H.), 2 ♂. Rio Urubamba (A.M.N.H.), 1 ♀. Upper Rio Tapiche (A.M.N.H.), 1 ♀. Chambireyacu (B.M.), 7 ♂. Hillipani (B.M.), 1 ♀. Tarapoto (B.M.), 2 ♂. Yurimaguas (B.M.), 3 ♂.

Brazil: Porto Walter, Upper Rio Jurua (A.M.N.H.), 1 ♂. Rio Jurua (B.M.), 7 ♂, 2 ♀.

No Data: (C.M.), 1 ♂.

Melinaea maenius (Hewitson)

This is the third of the three closely related species having the complete hindmarginal bar of the forewing but lacking the marginal series and the anal spot. These three species cannot be lumped together, since three different forms of the complex are found flying together in many localities. *M. maenius* differs

from the other two species in that the discocellular spots of the forewing are separate, not fused into a large spot or streak.

There are six geographic subspecies (fig. 23): *maenius* is found along the Amazon as far upstream as Teffé; *hicetas* is from northern Peru and eastern Ecuador; *taropotensis* comes from the middle Rio Huallaga; *cocana* is found as far north as the Rio Caqueta in Colombia and as far south as the lower Rio Ucayali in Peru; *juruaensis* is from the Rio Jurua in Brazil; *pothete* is from the Matto Grosso.

Melinaea maenius maenius (Hewitson) Plate IV, figure 57.

Mechanitis maenius Hewitson, 1860 (1852–1876), vol. 2, p. [27], pl. [14] Mechanitis II, fig. 7; Amazons. Bates, 1862, p. 551. Prittwitz, 1867, p. 260. Kirby, 1871, p. 34. Staudinger, 1885 (1884–1888), p. 72. Haensch, 1905, p. 164; 1909, p. 122. Riley and Gabriel, 1925, p. 31. Forbes, 1927, pp. 24, 26, 34. Bryk, 1937, pp. 478–479. Fox, 1940, p. 179. Forbes, 1948, p. 6.

The type is in the British Museum (Natural History), number 6987, a male from "Amazons". I have seen this from several well separated Amazon river stations from near the mouth up to Teffé and there is surprisingly little variation.

Specimens examined:

Brazil: Tabatinga (B.M.), 11 ♂. Teffé (B.M.), 14 ♂, 3 ♀. Tonantins (B.M.), 2 ♂. San Joas, Rio Solimoes (B.M.), 1 ♂. Obidos (B.M.), 1 ♂. Without locality (Z.S.B.), 1 ♂.

Melinaea maenius hicetas Godman and Salvin Plate IV, figure 58.

Melinaea hicetas Godman and Salvin, 1879, p. 150; Iquitos, Peru. Haensch, 1905, p. 145; 1909, p. 122, pl. 32e. Riley, 1919, p. 182. Riley and Gabriel, 1925, p. 24. Forbes, 1927, pp. 24, 33. Bryk, 1937, p. 477. Fox, 1940, p. 179. d'Almeida, 1951, pp. 24, 27.

The types are six males from Iquitos, Peru and from the Rio Napo, Ecuador, numbered 6997–7002 in the British Museum (Natural History). Distribution of this subspecies is in northern Peru and lower eastern Ecuador.

Specimens examined:

Ecuador: Rio Napo (B.M.), 1 ♂, 1 ♀.

Peru: Chambireyacu (B.M.), 3 ♂. Juramaguas (B.M.), 1 ♂. Iquitos (B.M.), 1 ♂, 2 ♀. Rio Ucayali (A.M.N.H., B.M.), 1 ♂, 3 ♀. Pucalipa (A.M.N.H.), 1 ♂. Rio Marañon (A.M.N.H.), 1 ♂.

No Data: (C.M.), 1 ♂.

Melinaea maenius cocana Haensch Plate IV, figure 59.

Melinaea menophilus cocana Haensch, 1903, p. 164; Coca, Ecuador; 1909, p. 122. Forbes, 1927, pp. 24, 33. Bryk, 1937, p. 477. Fox, 1940, p. 179.

The type is in the Berlin Museum. This subspecies is found in eastern Colombia, upper eastern Ecuador, and northern Peru.

Specimens examined:

COLOMBIA: Rio Caquetá (B.M.), 2 ♂. Without locality (B.M.), 1 ♂.
ECUADOR: Without locality (B.M.), 1 ♂, 1 ♀.
PERU: Pebas, Loreto (B.M., Z.S.B.), 3 ♂, 3 ♀. Rio Pacaya, Lower Rio Ucayali (B.M.), 1 ♀. Rio Ucayali (M.C.Z.), 1 ♂, 1 ♀. Yahuas Territory (B.M.), 1 ♂. Without locality (M.C.Z.), 1 ♀.

Melinaea maenius tarapotensis Haensch Plate IV, figure 60.

Melinaea menophilus tarapotensis Haensch, 1909, p. 122; Upper Amazons. Forbes, 1927, pp. 24, 33. Bryk, 1937, p. 478. Fox, 1940, p. 179.

The type is in the Berlin Museum. As Forbes (1927) noted, the original description is quite unrecognizable—as are most of the descriptions of new ithomines in "Seitz". I place this from material believed to be authentically identified in the British Museum (Natural History). Since the hindmarginal bar of the forewing is complete, it cannot belong with *menophilus,* although it is indeed quite similar in a general way. It is closest to *juruaensis* but has a much narrower postmedian fascia on the forewing and on the under side of the hind wing the postmedian series of black spots is vestigial. The few records at hand are from the middle Rio Huallaga.

Specimens examined:

PERU: Tarapoto (B.M.), 1 ♂, 2 ♀. Huayabamba (B.M.), 1 ♂.

Melinaea maenius juruaensis d'Almeida

Melinaea clara juruaensis d'Almeida, 1943, p. 165, upper figure of plate; Rio Jurua. Forbes, 1948, pp. 2, 6.

The holotype is a male in the collection of the Department of Zoology, State of São Paulo, Brazil.

Melinaea maenius pothete d'Almeida

Melinaea marsaeus pothete d'Almeida, 1945, pp. 12–13, pl. 2, figs. 1–3; Rio Verde, Matto Grosso, Brazil.

The types series consists of two males and five females in the collection of the National Museum, Rio de Janeiro. As d'Almeida's discussion and figures show, there is a range of variation in the black markings of the hind wing.

Specimen examined:

BRAZIL: Sebastopol, Labrea, Rio Purús (B.M.), 1 ♀.

Melinaea menophilus (Hewitson)

In general this species is distinguished by the absence of the submarginal series from both wings, the margin of the hind wing being either linear or scalloped in at the veins; the absence of the pale spot in the anal angle of the forewing; the incomplete hindmarginal bar of the forewing, with the distal part of the margin being tawny; and by the fact that the comma mark on the forewing is connected to its marginal triangle by a black line placed well away from Cu_1 and running out from the middle of the comma mark rather than from its top.

Typical *menophilus* is found (fig. 25) in southeastern Ecuador along the Rio Santiago and the Marañon, and south through Peru. *M. m. zaneka* is confined to a relatively restricted area in the upper Pastaza district of eastern Ecuador, almost entirely surrounded by *menophilus* but not overlapping it. *M. m. orestes* is found in east-central Peru and on the Rio Jurua, Rio Purús, and Rio Madeira of Brazil. Where the ranges of these subspecies meet intermediate forms are not uncommon, while within each population there is a great deal of variation, some of it striking.

Melinaea menophilus menophilus (Hewitson) Plate IV, figures 61, 62.

Mechanitis menophilus Hewitson, 1855 (1852–1876), vol. 1, p. [17], pl. [9] Mechanitis I, fig. 3 (not fig. 2); New Grenada. Hopffer, 1879, p. 119. Riley and Gabriel, 1925, p. 33.

Melinaea menophilus, Kirby, 1871, p. 24. Staudinger, 1885 (1884–1888), p. 72. Haensch, 1903, p. 163; 1909, p. 122, pl. 32e. Forbes, 1927, pp. 24, 26, 32–33, pl. 3. Bryk, 1937, pp. 476–477. Fox, 1940, p. 179. Forbes, 1948, pp. 6, 10. Bryk, 1952, p. 26.

Melinaea ishka Butler, 1870, p. 489; Bogota. Kirby, 1871, p. 641. Butler, 1873, p. 154. Riley and Gabriel, 1925, p. 27.

Melinaea hicetas flavosignata Staudinger, 1885 (1884–1888), p. 71. Haensch, 1909, p. 122. Forbes, 1927, pp. 24, 33. Ribeiro, 1931, p. 43. Bryk, 1937, p. 477. Fox, 1940, p. 179.

Melinaea hicetas, Staudinger (not Godman and Salvin), 1885 (1884–1888), p. 71; 1884 (*op. cit.*), pl. 30.

[*Melinaea menophilus membrosa* Forbes, 1927, p. 33. Bryk, 1937, p. 478.]

There is a good bit of normal variation within the population of this subspecies and some of it has been named. The types of *menophilus* are in the British Museum (Natural History), a male and a female from New Grenada numbered 6985 and 7049. The type of *ishka*, an absolute synonym, is in the same collection, a female from Bogota numbered 6986. A fairly common aberration where the yellow subapical spots happen to be present is *flavosignata*, the types of which are in the Berlin Museum. Forbes' *membrosa* was mentioned in his key (1927) but not described; it was intended as a reference to a previous description but neither of us (Forbes *in lit.*) can find it. Apparently it is an aberration with the black markings of the hind wing reduced or vestigial. Note that figure 2 of Hewitson's *menophilus* (*l.c.*) is *Mechanitis deceptus*.

Specimens examined:

Colombia: Rio Guaryuriba, Meta (A.M.N.H., C.M., Z.S.B.), 3 ♂, 3 ♀. Guayabetal, [Miranda] (A.M.N.H.), 1 ♂, 3 ♀. Rio Orteguaza, Rio Caquetá (A.M.N.H., C.M.), 6 ♂, 3 ♀. Rio Putumayo (A.M.N.H., C.M., M.C.Z., Z.S.B.), 54 ♂, 1 ♀. San Martin, Rio Meta (B.M.), 1 ♂, 3 ♀. Villavicencio (B.M.), 3 ♀. Rio Caquetá (B.M.), 1 ♂. Bogotá (B.M., M.C.Z.), 6 ♂, 7 ♀. Muzo (B.M.), 1 ♀. Without locality (A.M.N.H., B.M.), 3 ♂, 5 ♀.

Ecuador: Rio Santiago (A.M.N.H.), 3 ♂, 3 ♀. Jatanyacu (A.M.N.H.), 1 ♂. Curarai (B.M.), 1 ♂. Aguano (B.M.), 1 ♂. Sarayacu (B.M.), 1 ♂. Fortaleza (R.P.M.), 1 ♂. Arabella (R.P.M.), 1 ♂. Coca (Z.S.B.), 1 ♂. Without locality (B.M.), 1 ♂.

Peru: Ayachucho (C.M.), 1 ♀. Tarapoto (B.M.), 3 ♂, 2 ♀. Rio Pacaya, Rio Ucayali (B.M.), 1 ♂, 2 ♀. Rentema Falls, upper Rio Marañon (B.M.), 1 ♀. La Merced (B.M., Z.S.B.), 2 ♀. Upper Rio Marañon (A.M.N.H.), 5 ♂. Japalecio (B.M.), 1 ♂, 2 ♀. Rio Ucayali (A.M.N.H., B.M.), 1 ♂, 3 ♀. (A.M.N.H.), 2 ♀. Chambireyacu (B.M.), 3 ♀. Juruamaguas (B.M.), 4 ♂.

Brazil: Amazons (C.M.), 1 ♂, 1 ♀. Rio Madeira (?) [Type *ishka*] (B.M.), 1 ♂.

No Data: (C.M., M.C.Z.), 2 ♂.

Melinaea menophilus zaneka Butler Plate IV, figure 63.

Melinaea zaneka Butler, 1870, p. 490; Archidona, Ecuador. Kirby, 1871, p. 641. Staudinger, 1885 (1884–1888), p. 71. Haensch, 1903, p. 163; 1909, p. 122, pl. 32e. Forbes, 1927, pp. 24, 33. Riley and Gabriel, 1925, p. 52. Bryk, 1937, p. 478. Fox, 1940, p. 179. Forbes, 1948, p. 6.

Melinaea dora Streker, 1876 (1872–1900), p. 120; Esmeraldas, Ecuador. Haensch, 1909, p. 122. Bryk, 1937, p. 478.

Melinaea zaneka maculosa Haensch, 1903, pp. 163–164; Santa Inez, Ecuador; 1909, p. 122. Forbes, 1927, pp. 24, 33. Ribeiro, 1931, p. 43. Bryk, 1937, p. 478.

Melinaea zaneka discurrens Haensch, 1909, p. 122; east Ecuador. Forbes, 1927, pp. 24, 31. Bryk, 1937, p. 474. Fox, 1940, p. 179.

The type of *zaneka* is a male from Archidona, Ecuador in the British Museum (Natural History) numbered 7060. Streker's *dora* is an absolute synonym; the type is in the Chicago Museum of Natural History. Haensch's *maculosa* is the aberration having vestigial black markings on the hind wing; *discurrens* is an aberration with the hind wing borders developed as a series of teeth placed at the veins and has the distal part of the median band present; the types of both are in the Berlin Museum. The excellent series studied comes from a limited region of the upper Pastaza district of eastern Ecuador and includes these described aberrations and others as usual parts of the population. *M. m. menophilus* was not collected at stations where *zaneka* was found.

Specimens examined:

Colombia: Without locality (A.M.N.H., M.C.Z.), 1 ♂, 1 ♀.

Ecuador: Hacienda Santa Inez, Rio Pastaza (A.M.N.H., B.M., Z.S.B.), 6 ♂, 6 ♀. Haciendo San Francisco, Rio Mapota (A.M.N.H.), 3 ♂. Rio Topo (A.M.N.H.), 2 ♂. Between Rio Blanco and Sucua, Santiago-Zamora (A.M.N.H.), 1 ♂. Rio Jondachi [Type locality] (A.M.N.H.), 1 ♂. Between Mera and Zulay, Napo-Pastaza (A.M.N.H.), 1 ♂. Rio Arajuno (A.M.N.H.), 1 ♀. Between Macas and Rio Abonica, Napo-Pastaza (A.M.N.H.), 1 ♀. Abitagua, Rio Pastaza (A.M.N.H., A.N.S.P., C.M.), 4 ♂, 5 ♀. Huagrayacu (A.M.N.H.), 2 ♀. Hacienda Mascota, Rio Topo (A.N.S.P.), 2 ♂, 1 ♀. Puyo, Rio Pastaza (A.M.N.H., C.M.), 2 ♂, 1 ♀. Hacienda la Palmar, Rio Pastaza (A.M.N.H.), 4 ♂, 1 ♀. Rio Margajitas (A.M.N.H.), 1 ♀. Zamora (A.M.N.H.), 2 ♀. Zumbi, Santiago-Zamora (A.M.N.H.), 2 ♂. Maysico, Rio Nangarico, Santiago-Zamora (A.M.N.H.), 1 ♂. Canelos (B.M.), 1 ♂, 1 ♀. Sarayacu (B.M.), 1 ♂. Alpayacu, Rio Pastaza (B.M.), 2 ♂. Vicinity of Ambato (B.M.), 9 ♂, 3 ♀. Rio Topo (C.M.), 1 ♂, 1 ♀. Without locality (A.M.N.H., A.N.S.P., B.M., M.C.Z.), 6 ♂, 1 ♀.

Peru: Rentema Falls, upper Rio Marañon (doubtful) (B.M.), 1 ♂. Without locality (B.M.), 1 ♀.

Erroneous Data: Balzabamba, western Ecuador (B.M.), 1 ♀.

Melinaea menophilus orestes Salvin Plate V, figures 64, 65.

Melinaea orestes Salvin, 1871, p. 412; Pozuzo, Peru. Kirby, 1877, p. 697. Druce, 1876, p. 211. Staudinger, 1885 (1884–1888), p. 71. Weymer, 1892, p. 119. Moulton, 1909, p. 598. Haensch, 1909, pp. 122–123. Riley and Gabriel, 1925, p. 37. Forbes, 1927, pp. 24, 32, pl. 3. Fox, 1940, p. 179.

Melinaea chincha Druce, 1876, p. 211, pl. 17, fig. 3; Pozuzo, Peru. Kirby, 1877, p. 697. Haensch, 1905, p. 143; 1909, p. 122. Riley and Gabriel, 1925, p. 12. Forbes, 1927, pp. 24, 34. Bryk, 1937, p. 479. Fox, 1940, p. 179. Forbes, 1948, p. 6.

Melinaea magnifica Haensch, 1905, p. 145; Peru; 1909, p. 122. Forbes, 1927, pp. 24, 33. Bryk, 1937, p. 478.

The type of *orestes,* a male from Pozuzo, Peru, is numbered 6982 in the British Museum (Natural History). The type of *chincha,* an absolute synonym, is from the same locality and is in the same collection, numbered 6983. Types of *magnifica,* an aberration, are in the Berlin Museum.

Specimens examined:

Peru: Pucallpa (A.M.N.H.), 1 ♂. Rio Urubamba (A.M.N.H.), 1 ♂. Hillapani (B.M.), 1 ♂, 1 ♀. Juramaguas (B.M.), 3 ♂. La Union, Huacamayo near Carabaya (B.M.), 2 ♂. Puerto Maldonado (Z.S.B.), 1 ♂. Without locality (Z.S.B.), 3 ♂.

Brazil: Rio Jurua (A.M.N.H., B.M.), 6 ♂, 2 ♀. Senna, Rio Purús (B.M.), 1 ♂. Falls above San Antonio, Rio Madeira (B.M.), 4 ♂. Abuna, Rio Madeira (B.M.), 1 ♂.

No Data: (C.M.), 1 ♂.

Erroneous Data: Rio Napo (B.M.), 2 ♀.

Melinaea mothone (Hewitson)

By all the taxonomic characters used for separating species up to this point in this study, *mothone* could well be a part of *monophilus.* But because these two are widely sympatric it seems evident that if they are conspecific the *mothone* series must consist of aberrations of the *menophilus* series. Such a conclusion appears unreasonable to me. Furthermore, the penises of *mothone* and of *messenina* are definitely longer in proportion to the tegumen-uncus than is the case in *menophilus* and allies. The most useful external character for separating the two is that both *mothone* and *messenina* have the hind wing cell entirely black. A study of a good series from various localities indicates that while the comma spot in this species in connected by a line

running from its middle rather than from its top (as in *comma*), the comma mark itself sometimes crosses Cu_1 and sometimes does not.

Two subspecies are known (fig. 26): *messenina* from the tributaries of the Rio Negro of Brazil and Colombia, and *mothone* ranging from the Rio Putumayo south through Ecuador and Peru into Bolivia. *M. comma isocomma* is closely similar to *messenina* and *M. comma simulator* resembles *mothone*. Many like forms are to be found in *Mechanitis, Hypothyris, Hyposcada,* and *Oleria* in the Ithomiinae, and still more butterflies belonging to other families have the same pattern.

Melinaea mothone messenina Felder and Felder Plate V, figure 66.

Melinaea messenina Felder and Felder, 1865 (1864–1867), p. 356, pl. 45, fig. 11; Bogota, Colombia. Kirby, 1871, p. 24. Haensch, 1903, p. 164; 1909, p. 122. Forbes, 1927, pp. 24, 33. Bryk, 1937, p. 478. Forbes, 1948, p. 6. Bryk, 1953, p. 26.

The types of *messenina* are in the British Museum (Natural History) through the Rothschild collection.

Very few authentic locality records are available for this subspecies. Nearly all the specimens seen are old and bear generalized labels. It may have a wider range in Colombia than is indicated by the map (fig. 26).

Specimens examined:

Colombia: Bogotá (A.M.N.H., B.M., M.C.Z.), 8 ♂, 13 ♀. Rio Tigre, Rio Papamene (Z.S.B.), 1 ♂. Without locality (A.M.N.H., C.M.), 2 ♂, 1 ♀.

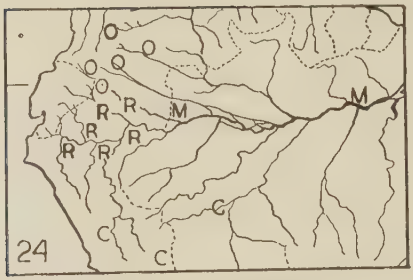
Brazil: Upper Rio Negro (B.M.), 1 ♀. Surumucu (B.M.), 1 ♀. Jatahy, Goyaz (?) (B.M.), 1 ♂. Without locality (B.M.), 1 ♀.

Melinaea mothone mothone (Hewitson) Plate V, figure 67.

Mechanitis mothone Hewitson, 1860 (1852–1876), vol. 2, p. [30], pl. [15] Mechanitis III, fig. 14; New Grenada. Kirby, 1871, p. 24. Druce, 1876, p. 208. Staudinger, 1885 (1884–1888), pp. 63, 68.

Melinaea mothone, Butler, 1873, p. 76. Weymer, 1890, p. 76. Haase, 1893, p. 52. Thieme, 1899, p. (16). Haensch, 1903, p. 165. Moulton, 1909, pp. 599, 600, pl. 33, fig. 2. Haensch, 1909, p. 122, pl. 32e. Kremky, 1925, p. 198. Forbes, 1927, pp. 24, 33, 34. Bryk, 1937, p. 479. Fox, 1940, p. 179. Bryk, 1953, p. 27.

Melinaea cydippe Salvin, 1871, p. 412; north Peru. Riley and Gabriel, 1925, p. 15. Bryk, 1937, p. 479.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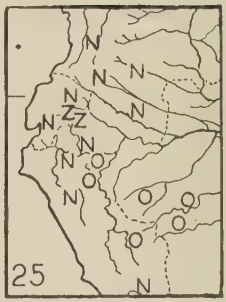
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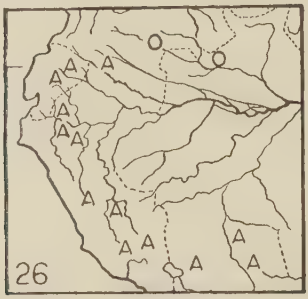
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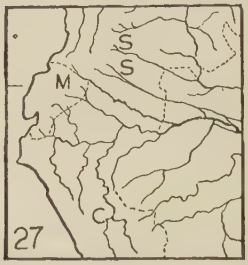
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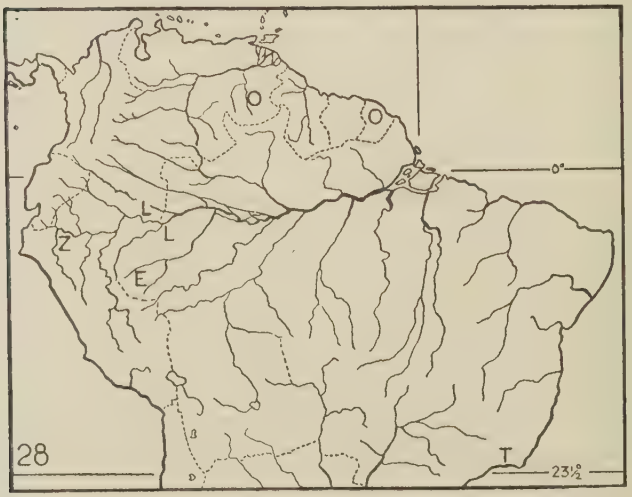
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The type should be in the British Museum (Natural History) but cannot be found. Hewitson's figure of his type does not clearly show the venational differences which would conclusively place the name in *Melinaea*, but the arrangement of the comma spot and other black markings are much more *Melinaea*-like than *Mechanitis*-like. The type of *cydippe*, an absolute synonym, is a male from north Peru, number 7010 in the British Museum (Natural History).

Specimens examined:

Colombia: Caucaya, Rio Putumayo (A.M.N.H.), 2 ♂.

Ecuador: Cuenca (B.M.), 2 ♂. Cururai (B.M.), 1 ♂, 1 ♀. Sarayacu, (B.M.), 1 ♂. Alpayacu, Rio Pastaza (B.M.), 2 ♂. La Zulay, Rio Puyo (C.M.), 1 ♂. Rio Puyo, Napo-Pastaza (A.M.N.H., C.M.), 10 ♂. Huagrayacu (A.M.N.H.), 1 ♂. Between Macas and Rio Abonica, Rio Upano (A.M.N.H.), 1 ♂. Hacienda San Francisco, Rio Mopoto (A.M.N.H.), 1 ♀. Rio Arajuno (A.M.N.H.), 1 ♂. Hacienda la Mascota, Rio Topo (A.N.S.P.), 4 ♂, 1 ♀. Rio Margajitas (A.M.N.H.), 1 ♀. Zumbi, Santiago-Zamora (A.M.N.H.), 2 ♀. Without locality (A.M.N.H., B.M., M.C.Z.), 3 ♂, 3 ♀.

Peru: La Union, Rio Huacamayo near Carabaya (B.M.), 2 ♂, 1 ♀. Moyabamba (A.M.N.H., B.M.), 3 ♂, 2 ♀. Rio Perene (B.M.), 1 ♂. Chanchamaya (B.M.), 2 ♂. Tarapota (B.M.), 2 ♂. Pozuzo (A.M.N.H.), 1 ♂. Tingo Maria (A.M.N.H.), 1 ♂. Quincemil, Cuzco (A.M.N.H.), 3 ♂. Upper Rio Marañon (A.M.N.H.), 3 ♂. Candarlara la Mar, Ayachucho (A.M.N.H., C.M.), 2 ♀. Without locality (B.M., C.M., Z.S.B.), 3 ♂, 2 ♀.

Bolivia: Rio Yacapani (C.M.), 4 ♂, 1 ♀. Buenavista, Sara (C.M.), 1 ♂. Coroico (B.M.), 1 ♀. San Jacinto (B.M.), 1 ♀. Chairo (B.M.), 1 ♀. Cochabamba (B.M.), 2 ♀. Cusillumi (M.C.Z.), 1 ♂. 8 days north of Cochabamba (M.C.Z.), 2 ♀. Cristal Mayu, Chapare (Collection de Foliart), 1 ♀. San Carlos Sarampiuni (Z.S.B.), 1 ♀. Yungas (Z.S.B.), 1 ♀. Without locality (B.M.), 2 ♀.

Brazil: Jatahy, Goyaz (doubtful) (B.M.), 2 ♂.

Figs. 24–28. Fig. 24—Distribution of *Melinaea marsaeus*. Symbols: C, *M. m. clara;* M, *M. m. marsaeus;* R, *M. m. rileyi;* O, *M. m. macaria.* Fig. 25—Distribution of *Melinaea menophilus*. Symbols: N, *M. m. menophilus;* O, *M. m. orestes;* Z, *M. m. zaneka.* Fig. 26—Distribution of *Melinaea mothone*. Symbols: A, *M. m. mothone;* O, *M. m. messenina.* Fig. 27—Distribution of *Melinaea comma*. Symbols: C, *M. c. comma;* M, *M. c. simulator;* S, *M. c. isocomma.* Fig. 28—Distribution of *Melinaea thera* and *M. lucifer*. Symbols: E, *M. l. eryx;* L, *M. l. lucifer;* O, *M. t. eratosthenes;* T, *M. t. thera;* Z, *M. l. lutzi.*

Melinaea comma Forbes

Three subspecies now are known with distribution (fig. 28) as follows: *M. c. isocomma* is found in the valleys of the Rio Caquetá and Rio Waupes of the Rio Negro in Colombian Amazons; *M. c. simulator* comes from eastern Eucador and *M. c. comma* from central Peru. The structure of the comma mark on the forewing is distinctive.

Melinaea comma isocomma Forbes Plate V, figure 68.

Melinaea isocomma Forbes, 1948, pp. 6–8, 10; pl. 1, fig. 2; upper Rio Negro, Colombia.

The type is in the Cornell University collection. In describing this from a single specimen, Forbes thought it, on morphologic grounds, to be a different species from *comma*. I have since found additional specimens of both, and the range of individual variation in pattern and in the legs connects the extremes and admits them comfortably into the same species.

Specimens examined:

Colombia: Upper Rio Negro (B.M., C.U.), 1 ♂, 1 ♀. Rio Caquetá (B.M.), 1 ♂. Bogotá (B.M.), 1 ♀. Muzo (Z.S.B.), 1 ♂. Without locality (A.M.N.H., B.M.), 2 ♂.

Melinaea comma simulator new subspecies Plate V, figure 69.

Melinaea mothone, Moulton, 1909, pl. 33, fig. 1.

Forbes (1948) noted that the specimen figured by Moulton (1909) might be an additional subspecies of *comma* but not having seen specimens did not name it. Meanwhile, twenty-one specimens have come to hand from eastern Ecuador. They resemble *M. mothone* very closely in size and in coloring. From *mothone, simulator* is distinguished as follows: the comma mark on the forewing is formed as a strong hook connected by a thick black line lying very close to Cu_1 and leading always to the top of the comma; in *mothone* the comma mark is round or at most only lightly hook-shaped, and the black line connecting it to the marginal triangle leads to its center and is placed well away from Cu_1, generally about in the middle of the cell. On the under side *simulator* has the black patch of the hind wing completely covering the end of the cell, not even the discocellular

veins being tawny, and only a small patch of tawny present at the apex of the wing; in *mothone* the black patch is broken so that there is some tawny in the end of the cell, sometimes in the bases of M_1-M_2 and M_2-M_3, but at least the discocellular veins are scaled with tawny even in the darkest individuals. The humeral angle of the hind wing on the under side always has some yellow scaling present in *simulator* and often this is bright yellow; in *mothone* it always is tawny red.

Type material.—Holotype male from Puyo, Oriente Ecuador; 1000 meters; February 1950; W. C. MacIntyre (C.M.). Allotype female from Puyo, Napo-Pastaza, Ecuador; 1000 meters; May 1946; W. C. MacIntyre (C.M.).

Paratypes.—2 ♂, upper Rio Marañon, Peru (probably Napo-Pastaza, Ecuador); December 2, 1929; Bassler (A.M.N.H.). 1 ♂, 1 ♀, Hacienda San Francisco, Rio Mapoto, Pastaza district, Ecuador; 1300 meters; F. M. and H. H. Brown (A.M.N.H.). 1 ♂, Puyo, Oriente Ecuador; W. C. MacIntyre (C.M.). Abitagua, Ecuador; November and June (A.M.N.H.). 2 ♂, Rio Pastaza, Ecuador (A.M.N.H.). 1 ♂, Jatan Yacu, Ecuador (A.M.N.H.). 1 ♂, Rio Jondachi, near Archidona, Napo-Pastaza, Ecuador (A.M.N.H.). 1 ♂, Hacienda Santa Inez, Rio Pastaza, Ecuador; March; F. M. and H. H. Brown (A.M.N.H.). 2 ♂, Rio Topo, Pastaza, Ecuador; November; F. M. and H. H. Brown (A.M.N.H.). 1 ♂, Rio Anzu, Ecuador; December; MacIntyre (A.M.N.H.). 1 ♂, Puyo, Napo-Pastaza, Ecuador; 1000 meters; December; F. M. and H. H. Brown. 2 ♂, Jatahy, Goyaz, [Brazil]; Pozul, 1898; from Oberthür collection; [locality wrong] (B.M.). 1 ♂, Archidona, Rio Napo, Ecuador; March-April, 1857 (B.M.). 1 ♂, Environs de Loja; from Dognin collection (B.M.). 1 ♂, Mera to Zulay, Napo-Pastaza, Ecuador; 1100 meters; December; F. M. and H. H. Brown (Brown collection). 1 ♀, Santa Inez, Ecuador; R. Haensch (Z.S.B.).

Melinaea comma comma Forbes Plate V, figure 70.

Melinaea comma Forbes, 1927, pp. 24, 25, 34–35, pl. 2, upper figure, pl. 3, lowest figure; Chanchamayo district, Peru. Bryk, 1937, p. 470. Fox, 1940, p. 179. Forbes, 1948, p. 8.

The type is in the Cornell University collection.

This central Peruvian subspecies is closely similar to *menophilus* and usually is mixed with it in collections, just as *simulator* is mixed with *mothone* and *isocomma* with *messenina*. In each case the formation of the comma mark serves to separate the *comma* series. The most northerly record seen is from the Santiago-Zamora district of Ecuador.

Specimens examined:

Ecuador (doubtful): Macas (R.P.M.), 1 ♀. La Merced, Rio Pastaza (B.M.), 1 ♂, 1 ♀.

Peru: Chanchamayo (B.M., C.U., U.S.N.M.), 5 ♂, 2 ♀. Perené (B.M.), 2 ♂, 2 ♀. Satipo (C.M.), 1 ♀. Hacienda Mosela, Rio Oxabama (Z.S.B.), 1 ♂.

Melinaea thera Felder and Felder

The two subspecies are easily recognized by the series of large round yellow or white spots placed singly between the veins on both sides of both wings. Above M_3 of the forewing these spots obviously are the subapical series; the others probably are the same series displaced distad. *M. t. thera* is from southeastern Brazil (fig. 28); *M. t. eratosthenes* is from French Guiana. Both are known only from a very few specimens and apparently are quite rare.

Melinaea thera thera Felder and Felder Plate V, figure 71.

Melinaea thera Felder and Felder, 1865 (1864–1867), p. 354; no locality cited. Kirby, 1871, p. 35. Haase, 1893, p. 51. Haensch, 1909, p. 124. Riley and Gabriel, 1925, p. 47. Forbes, 1927, p. 28. Bryk, 1937, p. 480.

The type is number 6980 in the British Museum (Natural History), a male without locality. The big round marginal spots led Forbes (1927) to suppose this might be *Hypothyris;* the three specimens in the British Museum have the venation and tufting of *Melinaea.*

Specimens examined:

Brazil: Itabapoana, Rio de Janeiro (B.M.), 2 ♂.

No Data: (B.M.), 1 ♂.

Melinaea thera eratosthenes Hall Plate V, figure 72.

Melinaea eratosthenes Hall, 1935, pp. 226–227, pl. 6, fig. 5; French Guiana. Bryk, 1937, p. 471. Fox, 1940, p. 179. Forbes, 1942, pp. 26–27; 1948, pp. 2, 3, 9, 10.

The type in the British Museum (Natural History) is a male from French Guiana. Apparently the only other specimen known is the male Forbes (1942) mentions from Akuriman on the Rio Caroni in Bolívar, Venezuela.

Specimen examined:

FRENCH GUIANA: Without locality (B.M.), 1 ♂.

Melinaea lucifer Bates

Three subspecies of this unusual species now are known (fig. 28). *lucifer* comes from the upper Amazon in Brazil and Peru, *lutzi* from the Rio Marañon in Peru and *eryx* from the Rio Jurua. The species retains the round single spots in the marginal position above Cu_2 but has lost the entire series on the hind wing. *M. lucifer* apparently derives from the same stock as *M. thera*. On distributional grounds there would be little objection to combining the two as a single species, but the pattern in *lucifer* is strongly modified.

Melinaea lucifer lucifer Bates Plate V, figure 73.

Melinaea lucifer Bates, 1862, p. 551; São Paulo, upper Amazons. Riley and Gabriel, 1925, p. 32. Bryk, 1937, p. 476 (part). Fox, 1942, pp. 1–3, fig. 1. Forbes, 1948, pp. 2, 9.

The type is in the British Museum (Natural History) numbered 7009. Staudinger (1885 (1884–1888)) misidentified the name, a mistake in which he was followed by Haensch (1909) and others.

Specimens examined:

BRAZIL: São Paulo de Olivençia (B.M.), 2 ♂.
PERU: Pebas (B.M.), 1 ♂.

Melinaea lucifer lutzi Fox Plate V, figure 74.

Melinaea lucifer lutzi Fox, 1942, pp. 1–3, fig. 2; upper Rio Marañon. Forbes, 1948, pp. 2, 3.

The type, a male, is in the American Museum of Natural History.

Specimens examined:

PERU: Upper Rio Marañon (A.M.N.H.), 1 ♂.
ECUADOR: Without locality (B.M.), 1 ♂.

Melinaea lucifer eryx d'Almeida

Melinaea hicetas eryx d'Almeida, 1951, pp. 24, 25, pl. 3, fig. 1; upper Rio Jurua, Acre, Brazil.

The type is in the Museu Nacional, Rio de Janeiro, a male from the upper Rio Jurua, and the only specimen known thus far.

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Explanation of Figures

Plate II

Fig. 29.—*Melinaea mneme* (Johansson), typical male, Mano River, French Guiana (C.M.).

Fig. 30.—*Melinaea mneme,* ab. *mauensis* Weymer, male, Kurupung, British Guiana (C.M.).

Fig. 31.—*Melinaea lilis imitata* Bates, male, Sixola River, Costa Rica (C.M.).

Fig. 32.—*Melinaea lilis parallelis* Butler, male, "Sixola, Costa Rica" in error, probably from Panama (C.M.).

Fig. 33.—*Melinaea lilis ezra* Fox, female, Cincinnati, Santa Marta range, Colombia (C.M.).

Fig. 34.—*Melinaea lilis lilis* Doubleday and Hewitson, female, Venezuela (C.M.).

Fig. 35.—*Melinaea lilis sola* Kaye, female, Cumanacoa, Sucre, Venezuela (C.M.).

Fig. 36.—*Melinaea lilis messatis* (Hewitson), female, Rio Opon region, north of Tunja, Department of Boyaca, Colombia (C.M.).

Fig. 37.—*Melinaea ethra* (Latreille), female, Gavea, Rio de Janeiro, Brazil (A.M.N.H.).

Fig. 38.—*Melinaea scylax* Salvin, female, San Mateo, Costa Rica (C.M.).

Fig. 39.—*Melinaea satevis satevis* (Doubleday and Hewitson), male, Province del Sara, Bolivia (C.M.).

Fig. 40.—*Melinaea satevis crameri* Godman and Salvin, male, Azemu, British Guiana (A.M.N.H.).

Plate III

Fig. 41.—*Melinaea idae idae* (Felder and Felder), female, Barro Colorado Island, Panama Canal Zone (C.M.).

Fig. 42.—*Melinaea idae vespertina* Fox, holotype male, Playas de Montalvo, Provincia Los Rios, western Ecuador (A.M.N.H.).

Fig. 43.—*Melinaea egina egina* (Cramer), male, Hyatanahan, Rio Purús, Brazil (C.M.).

Fig. 44.—*Melinaea egina paraiya* Reakirt, female, Pernambuco, Brazil (M.C.Z.).

Fig. 45.—*Melinaea mnemopsis* Berg, male, Province del Sara, Bolivia (C.M.).

Fig. 46.—*Melinaea maelus madeira* Moulton, male, Amazonas (M.C.Z.).

Fig. 47.—*Melinaea maelus purusana* Riley, male, Hyatanahan, Rio Purús, Brazil (C.M.).

Fig. 48.—*Melinaea maelus brunnea* Riley, holotype female, Bocca de Acre, upper Rio Purús, Brazil (B.M.).

Fig. 49.—*Melinaea maelus cydon* Godman and Salvin, female, middle Rio Marañon, Peru (A.M.N.H.).

Fig. 50.—*Melinaea maelus maelus* (Hewitson), male, lower Rio Putumayo, Amazonas, Colombia (C.M.).

Fig. 51.—*Melinaea maeonis maeonis* Hewitson, male, Rio Orteguaza, near 1° N, 75° W, Colombia (A.M.N.H.).

Fig. 52.—*Melinaea marsaeus rileyi* Fox, male, upper Rio Marañon, Peru (A.M.N.H.).

PLATE IV

Fig. 53.—*Melinaea marsaeus macaria* Godman and Salvin, male, Rio Orteguaza, Colombia (A.M.N.H.).

Fig. 54.—*Melinaea marsaeus macaria* Godman and Salvin, aberrational male, Rio Orteguaza, Colombia (A.M.N.H.).

Fig. 55.—*Melinaea marsaeus clara* Rosenberg and Talbot, paratype male, Yahuarmayo, southeastern Peru (B.M.).

Fig. 56.—*Melinaea phasiana phasiana* Butler, male, Porto Walter, upper Rio Jurua, Brazil (A.M.N.H.).

Fig. 57.—*Melinaea maenius maenius* (Hewitson), male, Rio Ucayali, Peru (M.C.Z.).

Fig. 58.—*Melinaea maenius hicetas* Godman and Salvin, holotype male, Iquitos, Peru (B.M.).

Fig. 59.—*Melinaea maenius cocana* Haensch, female, Peru (M.C.Z.).

Fig. 60.—*Melinaea maenius tarapotensis* Haensch, female, Tarapoto, Peru (B.M.).

Fig. 61.—*Melinaea menophilus menophilus* (Hewitson), typical female, Sani Beni, northeastern Peru (Collection F. M. Brown).

Fig. 62.—*Melinaea marsaeus egesta* Godman and Salvin, holotype male, Interior of Colombia (B.M.).

Fig. 63.—*Melinaea menophilus zaneka* Butler, female, trail between Mera and Zulay, Napo-Pastaza district, eastern Ecuador (collection F. M. Brown).

PLATE V

Fig. 64.—*Melinaea menophilus orestes* Salvin, male holotype, Pozuzo, Peru (B.M.).

Fig. 65.—*Melinaea menophilus orestes* Salvin, male of ab. *magnifica* Haensch, Pucallpa, Peru (A.M.N.H.).

Fig. 66.—*Melinaea mothone messenina* Felder and Felder, female, Bogotá, Colombia (M.C.Z.).

Fig. 67.—*Melinaea mothone mothone* (Hewitson), female, Candalara La Mar, Ayachucho, Peru (A.M.N.H.).

Fig. 68.—*Melinaea comma isocomma* Forbes, male, Colombia (A.M.N.H.).

Fig. 69.—*Melinaea comma simulator* new subspecies, male paratype, trail between Mera and Zulay, Napo-Pastaza district, eastern Ecuador (collection F. M. Brown).

Fig. 70.—*Melinaea comma comma* Forbes, female, Satipo, Peru (C.M.).

Fig. 71.—*Melinaea thera thera* Felder and Felder, male holotype, Itabapoana, Rio de Janeiro, Brazil (B.M.).

Fig. 72.—*Melinaea thera eratosthenes* Hall, male holotype, French Guinea (B.M.).

Fig. 73.—*Melinaea lucifer lucifer* Bates, male holotype, São Paulo de Olivença, Brazil (B.M.).

Fig. 74.—*Melinaea lucifer lutzi* Fox, male holotype, upper Rio Marañon, Peru (A.M.N.H.).

Addendum

Through the kindness of the curator, Dr. Walter Forster, the Ithomiidae from the Zoologische Sammlung des Bayerischen Staates, Munich, West Germany, were sent me for study, but were received too late to include in this paper. Because of the interesting material represented, locality records for the Munich collection are presented below.

Melinaea mneme

British Guiana: Demarra, 1 ♂. Surinam: Paramirabo, 1 ♀; no locality, 4 ♂. Brazil: Tara, Rio Tapojos, 1 ♂, 1 ♀; Teffé, 3 ♂, 2 ♀; Manicore, Rio Madeira, 1 ♀; Obidos, 2 ♂, 2 ♀; Manaos, 1 ♂; "Amazons" (Fassl col.), 26 ♂, 17 ♀. Colombia (doubtful): 1 ♀.

M. lilis flavicans

Mexico: 1 ♀. *M. l. imitata.* Jalapa, 1 ♀; Palamaros, Oaxaca, 1 ♂; Cordoba, 1 ♂. Guatemala: 1 ♂. Honduras: 3 ♂, 1 ♀. Colombia (error): 1 ♂. *M. l. parallelis.* Panama: Matachin, 1 ♂. *M. l. lilis.* Venezuela: Maracay, 2 ♂. *M. l. messatis.* Colombia: 1 ♂, 2 ♀.

M. ethra

Brazil: Santa Catharina, 2 ♂, 2 ♀.

M. scylax

Panama: Chiriqui, 2 ♂, 1 ♀.

M. satevis satevis

Bolivia: upper Rio Chipiri, 2 ♂; Sarampiuni, San Carlos, 1 ♂, 1 ♀; no locality, 1 ♂.

M. idae idae

Colombia: Muzo, 1 ♂; Magdalena river valley, 1 ♂. No locality, 1 ♂. Ecuador (error): Palmar, W. Ecuador (Haensch), 1 ♂. *M. i. vespertina.* Colombia (error): Muzo, 1 ♂. Ecuador: Santa Domingo Colorados, Esmeraldas, 1 ♂; San Mateo, Esmeraldas, 2 ♀; Palmar, 1 ♂; Bucay, 1 ♂.

M. egina egina

Brazil: Belem, Para, 1 ♀; Obidos, 2 ♂; Itaituba, Rio Tapajoz, 6 ♂, 2 ♀; Manaos, 1 ♀; Teffé, 1 ♂; Amazonas (Fassl), 19 ♂, 10 ♀. Bolivia:

Guayamerin, 2 ♂. *M. e. paraiya.* BRAZIL: 2 ♂, 2 ♀. GUIANA (error): 2 ♀.

M. mnemopsis

BOLIVIA: Santa Cruz, 3 ♂, 1 ♀.

M. maelus madeira

BRAZIL: Amazons, 2 ♂. *M. m. purusana.* BRAZIL: Rio Purús, 1 ♂. *M. m. cydon.* BRAZIL: Manaos, 1 ♂; Ega, 1 ♂. PERU: Pucallpa, 1 ♂.

M. maeonis maeonis

COLOMBIA: Muzo, 1 ♂.

M. marsaeus egesta

COLOMBIA: Magdalena River valley, 1 ♂. *M. m. rileyi.* PERU: Jurimagues, 1 ♂; Pebas, 1 ♀. *M. m. macaria.* ECUADOR: 1 ♂.

M. phasiana manga

"AMAZONS", 1 ♀.

M. maenius maenius

No data, 1 ♂. *M. m. cocana.* PERU: Pebas, 1 ♂.

M. menophilus menophilus

COLOMBIA: Rio Guayabera, 1 ♂; Mocoa, Rio Putumayo, 1 ♂; Source of Rio Orinoco (?), 1 ♀. ECUADOR: Coca (Haensch), 1 ♂; La Merced, 1 ♀. PERU: 1 ♂. "Amazonas", 1 ♂. *M. m. zaneka.* ECUADOR: Santa Inez (Haensch), 1 ♂, 3 ♀; upper Pastaza, 1 ♂; no locality, 2 ♂. *M. m. orestes.* PERU: Pto. Maldonado, 1 ♂; no locality, 5 ♂ (one is ab. *magnifica*).

M. mothone messenina

COLOMBIA: Rio Tigre, Rio Papamene, 1 ♂. *M. m. mothone.* PERU: 1 ♂, 1 ♀. BOLIVIA: Yungas, 1 ♀; San Carlos, Sarampiuni, 1 ♀.

M. comma isocomma

COLOMBIA: Muzo, 1 ♂. *M. c. simulator,* new subspecies. *Paratype* female, Santa Inez, Ecuador (R. Haensch, 1903). *M. c. comma.* PERU: Hda. Mosela, Rio Oxabamba, 1 ♂.

FOX: TRIBE MELINAEINI

FOX: TRIBE MELINAEINI

FOX: TRIBE MELINAEINI

FOX: TRIBE MELINAEINI

A NEW CONCEPT INVOLVING THE SUBFAMILY ACRIDINAE (ORTHOPTERA: ACRIDOIDEA)

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For a number of decades past orthopterists have had a variety of ideas as to what morphological features could be utilized to distinguish the grasshopper subfamilies long known as the Oedipodinae and the Acridinae (the latter in much past literature called the Truxalinae). A great number of the genera could be referred without hesitation to one or the other assemblage by the general characters of the head and pronotum, but others were rather transitional in these features. Also certain genera, which had been placed in each, were markedly divergent in some respects from others, to which in all other features they appeared to be closely related. It had also been felt that, instead of dealing with but two subfamilies a third, largely intermediate between marked and classical representatives of each of the long recognized subfamilies, might be required. The matter of discrete definition, however, even after allowing for a few exceptions in each catagory, remained a real problem if the segregation of the apparent subfamilial entities was to be placed on a firm foundation.

In 1942 Dr. B. P. Uvarov gave as his belief [1] that the general body shape, and more particularly the degree of the facial angle, one of the classic features which had been used to distinguish the two subfamilies, was without value," since many unquestionable Acridine genera have the face vertical, while it is definitely oblique in some Oedipodinae." He continued, "On the other hand, an excellent subfamilial character is provided by the stridulatory mechanism, which in Acridinae (when present) consists of a series of pegs on a special ridge of the hind femur working against the raised second radial vein, while in Oedipodinae the femoral ridge is devoid of pegs and works against a false discoidal vein which is either simply raised, or raised and serrated." In 1953 the senior author of this paper in comment-

[1] Trans. Amer. Entom. Soc., LXVII, p. 336.

ing[2] upon Uvarov's postulate said, " Unfortunately this statement is no more broadly applicable than the long-used, more orthodox determinants, and it has definite exceptions in most faunas."

In 1950 Dr. V. M. Dirsh, an associate of Dr. Uvarov, more broadly applied Uvarov's 1942 hypothesis in a revision of the " group Truxales ",[3] emphasizing the development or absence of internal caudal femoral " pegs " as a basic classificatory feature. He there defined two " tribes", as follows: " Tribe *Truxalini* n. Internal face of hind femur with a row of stridulatory pegs. Vena mediastina and vena radialis anterior of elytron convex, ridge-shaped; area mediastina and area scapularis prominent, pellucid, with regular sparse transverse veinlets (this character is more developed in males than in females). Vena intercalata absent. . . . Tribe *Acridini* n. Internal face of the hind femur without stridulatory pegs. Vena mediastina and vena radialis anterior not ridged; area mediastina and area scapularis not pellucid and not expanded (i.e. the stridulatory organs, as in the tribe *Truxalini* absent). Vena intercalata present, sometimes irregular." The first mentioned tribe, built around the genus *Truxalis* Fabricius, he considered to include " about one hundred genera examined by the author." The second one, formed about *Acrida* Linnaeus, 1758, he noted " includes about seventy examined genera." The same author in 1956, in an important study on the phallic complex in the Acridoidea, as an adjunct to his major thesis, put forward with greater emphasis the concept of the presence or absence of stridulatory ability as a fundamental taxonomic character,[4] following the lines of Uvarov's 1942 suggestion and his own interpretations of it in 1950. In this paper Dirsh summarized the features which he regarded as important in determining the composition of supra-generic elements usually placed in the two subfamilies. Of what he considers the subfamily Acridinae he noted " this subfamily is now considered to include only those genera which have been included previously in

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[2] " The Grasshoppers and Locusts (Acridoidea) of Australia." Vol. II, p. 15, part of footnote 11.

[3] Eos. Tomo-extraordin., pp. 122–123.

[4] Trans. R. Entom. Soc. London, 108, pp. 257–258.

the tribe Acridini (Dirsh 1950), with the addition of the former subfamily Oedipodinae. . . . The Acridinae are characterized by the absence of stridulatory pegs on the internal side of the hind femur and, in most cases, by the presence of a more or less well-developed intercalary vein in the medial area of the elytron." Under the "Group Oedipodae" he comments on Uvarov's remarks about the presence of a stridulatory intercalary vein in the medial area of the tegmina as an oedipodine character. He adds, "However, a complete series of intermediates from a well formed and serrate stridulatory vein to a very irregular and clearly non-functional structure can be seen when the genera of the Acridae and the former Oedipodinae are considered together. Moreover, in some genera the intercalate vein may be more or less well-developed in the male, but absent in the female. This makes it impossible to retain the Oedipodinae as a subfamily any longer, and they are regarded as a group of the subfamily Acridinae."

The present authors in 1959, in commenting upon Dirsh's conclusions, noted,[5] "It would thus appear to the neophyte that the decades-old problem of Acridinae vs. Oedipodinae has been at last settled." Unfortunately the whole matter is much less simple than the mere presence or absence of stridulatory "pegs", or of a tegminal intercalary vein. As we then pointed out the North American species *Radinotatum carinatum* has two geographic subspecies in Florida, one in the northern part of the state, the other in the southern, with an area of intergradation in a limited central section of the state. While *R. c. carinatum* has pegs in the male, it lacks them in the female; *R. c. peninsulare* (the more southern subspecies) lacks them in both sexes. As we stated there "the point at issue . . . is whether great taxonomic weight can be given to a character which is sex correlated in many cases, variable even at the subspecific level, and primarily of a functional rather than a phylogenetic nature." Of 36 North American genera currently assigned to the Oedipodinae two, *Coniana* and *Cibolacris*,[6] possess denticles on the internal carina of the caudal femora. The first of these has a marked series in

[5] Entom. News, LXX, pp. 245–249.

[6] Placed in the "group Oedipodae" by Dirsh, 1956.

males, none in females. The second possess denticles in both sexes, the males having a more extensive series. We freely admit internal genitalic characters are sexual, but that they have an inherent phylogenetic background can hardly be questioned. They are also " functional ", but with a very different connotation from an external stridulatory apparatus.

In the work of preparing the keys to the subfamilies of the Acrididae in the first volume of our " Monograph of the Orthoptera of North America ", now in press, we were under the necessity of weighing carefully the status of the nominal subfamilies Acridinae and Oedipodinae, taking into account external features and internal genitalic ones, and thus reaching definite conclusions to be utilized in our monograph. Entirely de novo we weighed external features, including the stridulatory equipment already mentioned, and the internal genitalia, studying almost every genus found in North America which had been referred to the two classic subfamilies. We also analyzed numerous other genera, Neotropical and Old World, along the same lines, and found these supported the conclusions reached from the Nearctic ones.

As far back as 1941 Roberts [7] pointed out that the Acridinae-Oedipodinae (as then understood) could not be separated on the basis of differences in the phallic complex. With this our present examination of many genera fully agrees. No single character or combination of characters in the phallic complex will permit the separation of these two groups. The characters of the female spermathecae are equally stable. However, when we turn to the presence or absence, or degree of development of stridulatory " pegs ", we find there what one might naturally expect, i.e. such pronounced differences in this respect in closely related genera, on the basis of a large series of morphological characters, that we are compelled to regard this stridulatory equipment as of far less importance than did either Uvarov or Dirsh. We have analyzed an extensive series of genera, both for the presence or absence, or character when present, of stridulatory apparatus. The results of our analysis of North American genera referred to above is here presented in tables 1 and 2 at the end of the present discussion.

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[7] Proc. Acad. Nat. Sci. Phila., XCIII, p. 225.

As to the presence of a definite, or at least clearly evident rudimentary, tegminal intercalary vein in genera which have always been regarded as members of the Acridinae as previously understood, we find, in an admittedly incomplete check, at least ten genera which would fall into this category. Of North American genera these comprise *Bootettix*, *Pedioscirtetes*, *Chloealtis*, *Drepanopterna*, *Ligurotettix* and *Goniatron*. Of Neotropical genera it is indicated in *Laplatacris* and *Peruvia*, as well as in the Old World genera *Ramburiella* and *Orthochtha*. Many years ago, as noted by us in 1959, the senior author pointed out [8] the degree of variability in the development of the intercalary vein in the Neogaeic genus now known as *Rhammatocerus*. A similar condition is now before us in the Argentinian *Parorphula gramínea*. While the great bulk of the genera which had been placed, and with warrent as then understood, in the Acridinae do not have indications of an intercalary vein in the tegmina, a number of genera, with similar warrant, do possess intercalary veins, although they are less elevated than in *Mecostethus*, to which special emphasis was drawn by Dirsh. We have not made a comprehensive check of the North American genera, which were in the past referred to the Acridinae, as to the presence or degree of development of a tegminal intercalary vein. We have been concerned solely with determining the value of the presence or absence of a tegminal intercalary vein, and of denticles on the internal carina of the caudal femora as phylogenetic, rather than adaptational, features. The tables and discussion here presented have this objective, statistical rather than argumentative.

A resumé of a considerable number of Neotropical genera, which in all previous classifications have been referred to the Acridinae, shows most interesting results, particularly in the extent to which the female sex varies in its possession of denticles on the internal carina of the caudal femora. As a very large portion of the North American genera of the classic old Acridinae—in fact all but a few Holarctic ones—are clearly of either Neotropical or Sonoran derivation, the evidence of these often related, more southern genera is of particular interest and value to the present discussion. To clarify some parts of table 1, based

[8] Proc. Acad. Nat. Sci. Phila., 1906, p. 41.

solely on genera occurring in North America, we are here discussing in more detail some points summarized in the table.

The tribe *Hyalopterygini* (olim group Hyalopteryges [9]) consists of a group of New World genera, the most extreme conditions of which are found in the genera *Paulacris*, *Hyalopteryx* and *Guaranacris*, which, among other distinctive features, possess pronounced pane-like fenestrate areas in the discoidal area of the wings, and these in the genera above mentioned are unusually developed. None of the genera comprising the tribe, all of which are now before us, possesses any denticles on the internal carina of the caudal femora. But a single genus of the tribe reaches North America, i.e. *Metaleptea*. All other morphological features of the members of the tribe are essentially acridine (using the word in the historic sense). That the wings, which are very highly specialized, probably are the agencies which here basically produce sound, and not femoral denticles, is to us a matter aside from the basic morphological fact involved, i.e. that here we have a group which in all its encompassing morphology is clearly an acridine one (again in the classic, if not in the Dirshian sense).

In the rather closely related Achurumini (olim Achuri [10]) the male of *Achurum*, as here noted, shows distinct denticles on the internal carina of the caudal femora and none in the female.

To return momentarily to the related genus *Radinotatum*, of which *R. carinatum* has already been discussed, the male sex of the Texan and Mexican *R. minipenne* shows a few denticles proximad, none in the female. In this genus tegminal length is apparently the governing factor as to whether denticles or "pegs" are present, a hardly permissible feature to put forward as a major phylogenetic criterion, knowing as we do that it varies in subspecies of a single species.

The genus *Bootettix* of the southwestern United States and northern Mexico has in the male well-marked denticles on the femoral carina, but none in the female, while the intercalary vein of the tegmina of the male is reasonably well-marked, although

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[9] Revised by Rehn in 1944 (Trans. Amer. Entom. Soc., LXX, pp. 181–234, 37 text-figures, pl. V).

[10] See Hebard, Trans. Amer. Entom. Soc., XLVIII, pp. 89–102, pl. IV, figs. 1–9 (1922).

somewhat irregular in trend, and it, as well as much of the adjacent surface of the tegmina, bears distinct granulations. Here is the development of an intercalary vein as well as (in the male only) femoral denticles. The genus *Pedioscirtetes*, which tentatively can be referred to the same tribe as *Bootettix*, also has marked denticles on the femoral carina in the males, but lacks as definite development of the intercalary vein.

Certain New World genera which are unquestionably closely related in other features of overall morphology and have also been considered as closely related, i.e. *Parachloebata* of Cuba, *Dichromorpha* of all the Americas, *Orphulina* of the West Indies and Central America, and *Orphulella*, also of all the Americas, show the paradoxical situation that *Parachloebata*, a Cuban endemic, has no denticles on the femoral carina in the male, and the other three genera all agree in having them. This situation, to those well acquainted with all the genera in the field, as well as in the laboratory, shows the utter weakness of using a purely stridulatory development as a basic feature, aside from the lack of logic in using one generally found only in a single sex for the differentation of subfamilies. To segregate *Parachloebata* from the other three genera above mentioned purely on the basis of means of sound production in three and its absence in one would vitiate the whole principle under which working zoologists are endeavoring to determine phylogenetic relationships.

The genus *Cocytotettix* (olim *Fenestra*) has no denticles on the femoral carina in the male, and here, as in the Hyaloptergini, the wings of the male have broad fenestrate areas in the discoidal field, but *Cocytotettix* is well removed from that tribe by numerous morphological features, a few being the general character of the head, antennae, pronotum, limbs and external genitalia in the male. The female of *Cocytotettix* has no femoral denticles, but the related Neotropical genus *Leurocerus* has them in the female (the male sex not at present available), and the genus *Sinipta*, a not widely removed relative of *Cocytotettix*, has femoral denticles in both sexes. The closely related West Indian genus *Caribacris* has femoral denticles in the male, but the condition in the female sex cannot be determined, as it is not now available.

The North American and Mexican genus *Syrbula* has femoral denticles in both sexes, while the Mexican and Central American genus *Machaerocera,* has no denticles in either sex, nor does the related genus *Cumarala,* or the African analogue of *Machaerocera,* i.e. *Holopercna.* Similarly the perfectly typical acridine Neotropical genera *Thyriptilon* and *Parorphula* have no femoral denticles in either sex. The Neotropical genus *Orphula* is in every other respect a typical acridine (in the historic sense), yet neither sex possesses femoral denticles. The Central American genus *Silvitettix* possesses well-marked femoral denticles in the male, but lacks them in the female, as is also true of the striking South American genus *Compsacris.* Similarly the Central American genus *Leuconotus* has denticles in male, but we are unable at this writing to check the female sex. The South American genus *Stereotettix,* a not at all distant relative of the North American *Psoloessa,* which possesses them, has no femoral denticles in either sex.

The South American genus *Peruvia* (olim *Toxopterus*) has distinct femoral denticles in the male and none in the female, while the very closely related genus *Fenestra* (olim *Dichroatettix*) lacks femoral denticles in both sexes. The distinctive South American genus *Staurorhectus* has well-marked denticles in the male and none in the female, while the Mexican genus *Melanotettix,* which is definitely an acridine (in the classic sense) has no femoral denticles in either sex. In our tabulation of a number of North American genera (table 1) we have already shown that the North American and Mexican genus *Boopedon* has femoral denticles in both sexes, while the very closely related *Morseiella* of Mexico and the southwestern United States possesses them in the male but none in the female. The South American genus *Euplectrotettix* has distinct femoral denticles in both sexes, while the closely related *Rhammatocerus* (olim *Plectrotettix* and *Scyllina* of numerous authors but not of Stål) has denticles well marked in the male but absent in the female, and the same is true of Stål's *Scyllina* and *Scyllinops* of Rehn, both equally close in other morphological respects to *Euplectrotettix.* On the other hand the not distantly related genus *Borellia* has denticles in both sexes, and this is also true of the relatively

aberrant acridine Andean genus *Meloscirtus.*

The natural cohesiveness of many of the genera discussed above is attested by their agreement in many elements of orthodox morphology. The use of a purely secondary stridulatory feature as a basic subfamily dividing character is to our minds contrary to the principles of comparative morphology, and also of a classification which expresses phylogeny.

Conclusions.—Over 140 genera of New and Old World acridids belonging to the nominal subfamilies Oedipodinae, Acridinae, and Truxalinae were examined by the authors. This investigation included a critical analysis of the internal genitalia of both sexes, plus a thorough examination of their external morphology. Special attention was given to the presence or absence of stridulatory pegs on the caudal femora and an intercalary vein in the tegmina. The following conclusions have resulted from this study:

1. The classification proposed by Dirsh in which the Acridinae includes the groups Acridae, Pargi, and Oedipodae, and the Truxalinae contains only the tribe Truxalini, is based upon superficial characters. These are: presence or absence of stridulatory pegs on the caudal femora and presence or absence of an intercalary vein on the tegmina. We have demonstrated that closely related genera, in one case even subspecies of a single species, would have to be placed in different subfamilies if these criteria were used. No genitalic characters support this system. On this basis we reject Dirsh's classification.

2. While the extremes of development in genera assigned to the nominal subfamilies Oedipodinae and Acridinae (as understood by most American authors) are sufficient to support the present classification, many genera are annectant. These genera cannot be satisfactorily assigned to either " subfamily ".

3. On the basis of the data presented we recognize only one subfamily to include those genera previously assigned to the Acridinae, Oedipodinae, and Truxalinae (sensu Dirsh). Nomenclatural considerations indicate the correct usage for this assemblage to be Acridinae.

Table 1. Analysis of Nearctic genera previously referred to the Acridinae, as to the possession of denticles on the internal carina of the caudal femora.

	Males	*Females*
Achurum	Present	Absent
Radinotatum	Present to absent (See preceding comments)	Absent
Mermiria	Present mesad	Absent
Syrbula	Present	Present
Bootettix	Present proximad	Absent
Pedioscirtetes	Present	Absent
Acrolophitus	Present proximad	Absent
Opeia	Short median series	Absent
Amblytropidia	Proximo-median series	Absent
Amphitornus	Very short median series	Very short median series
Esselinia	Very short median series	Absent
Eritettix	Very short median series	Absent
Macneillia	Very short median series	Absent
Mesochloa	Distinct but short series	Absent
Phlibostroma	Very short median series	Present
Cordillacris	Short median series	Present
Orphulella	Definite series	A few minute ones present
Clinocephalus	Proximal series present	Proximal series present
Dichromorpha	Definite series	Absent
Chloealtis	Extensive series in proximal half	One small group present mesad
Napaia	Median group present	Absent
Acantherus	Median group present	Absent
Horesidotes	A few mesad	Absent
Chorthippus	Lengthly series present	Few weak denticles mesad
Aeropedellus	Lengthly series present	Few weak denticles mesad
Bruneria	Median group present	A few mesad
Rhammatocerus	Lengthly series present	A few mesad
Psoloessa	Lengthly series present	Well marked series
Ageneotettix	Limited series	Small series in proximal third
Zapata	Very short median series	Absent
Eupnigodes	Very short median series	Absent
Drepanopterna	Spaced proximal series	Absent
Boopedon	Well marked series	Present
Morseiella	Well marked series	Absent
Mecostethus	Carina well elevated, but without denticles	Carina also well elevated but no denticles
Goniatron	Well marked series covering most of carina	A similar series proximad only
Heliaula	A mesad and meso-proximal series present	A small group mesad

Table 2. Analysis of Nearctic genera previously assigned to the Oedipodinae, as to the presence of a tegminal intercalary vein, and notes on the wings.

	Males	*Females*
Arphia	Elevated and with tooth-like nodes	The same
Chortophaga	Elevated, but with no nodes	The same
Chimarocephala	Elevated with granulations, but no true nodes	The same
Encoptolophus	Elevated with nodes	Elevated, but with no nodes
Camnula	Elevated with nodes	The same
Hippiscus	Elevated with nodes	Elevated, but with no nodes
Pardalophora	Elevated with distinct nodes	Elevated, with indistinct nodes or lacking nodes
Xanthippus	Strongly developed and elevated, but without nodes	The same
Cratypedes	Elevated and faintly granulose	The same
Agymnastus	Distinct, regular and nodulose	Irregular, less pronounced, weakly nodulose
Leprus	Marked and finely nodulose	Less evident, without nodes
Tropidolophus	Poorly developed; adjacent cubitus and associated membrane with granulations	The same
Dissosteira	Elevated, with spaced nodes	Weakly elevated, with smaller spaced nodes
Spharagemon	Distinct but little elevated, finely nodulose	The same
Scirtetica	Moderately elevated, it and some adjacent veins and membranes granulose	The same
Tomonotus	Distinct, little elevated, finely nodulose	The same
Lactista	Distinct but low, finely granulose-nodulose	The same
Platylactista	Distinct, little elevated, obscurely nodulose	The same
Microtes	Distinct but low, no more granulose than adjacent veins and membranes	The same

Table 2 cont'd.

	Males	*Females*
Mestobregma	Marked; surfaces of all long tegminal veins and membranes between spiculate, intercalary no more so than other veins, wings with cross-veins in anterior field in part at least with minute nodulose points	The same
Rehnita	Distinct, moderately elevated, with the same minute granulations	The same
Metator	Distinct, little elevated, weakly granulate, adjacent membranes similarly micro-granulose	The same, except that adjacent membranes are not microgranulose
Psinidia	Essentially as in *Metator*	The same
Derotmema	Distinct, moderately elevated as are both anal veins; no evident nodulosities; alar surface as in *Mestobregma*	The same
Conozoa	Well marked, moderately elevated, with weak nodulosities	The same
Trimerotropis	Well marked, its surface and that of both tegminal alar veins with nodulosities, those of anal veins less marked	The same
Shotwellia	Evident, but low, with few nodulosities	The same
Circotettix	Marked and elevated, surface of it and both anal veins with nodulosities; wings with cross-veins distad in anterior field in large part with nodulose divisions; radiate veins thickened, with their dorsal surfaces bearing numerous minute denticles	The same, except nodulosities of anal veins less evident and without minute denticles on the dorsal surfaces of the radiate veins

Table 2 cont'd.

	Males	*Females*
Aerochoreutes	Definite and with nodulosities; radiate veins of wing thickened; humeral trunk much thickened on ventral surface	Indefinite and without nodulosities; radiate veins of wing little thickened; humeral trunk little thickened on ventral surface
Hadrotettix	Present but never marked, with nodes humeral trunk strongly elevated	Present but never marked, without nodes, humeral trunk not elevated on ventral surface
Trepidulus	Distinct, more elevated than other longitudinal veins, its surface no more nodulose or rugulose than remainder of tegminal surface	The same
Coniana	Irregular, indirect, surface without evident nodulosities, both anal veins elevated and with some nodulose tendency	Distinct, direct, otherwise as in male
Xeracris	Wavy and indirect, without nodulosities	Straight, without nodulosities
Cibolacris	No distinct intercalary vein, instead with some poorly defined and sparsely placed tubercles on the irregular reticulations	The same
Heliastus	Not clearly defined in a close reticulation, without nodulosities or varying to having a few scattered nodes	The same
Anconia	Distinct, much of its surface with nodulosities	Distinct but with surface nodulosities hardly evident

REVISION OF THE GENERA OF THE FAMILY CAENIDAE (EPHEMEROPTERA)

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The family Caenidae is a group which has grown by addition and subtraction without any kind of review or revision since its inception as "Section 7" in the Revisional Monograph of A. E. Eaton in 1883. The result appears to me to be generic groupings which are both illogical and unnatural and, subsequently, which now block our understanding of the natural processes acting upon and within the populations of these ephemerids. Therefore, as the first step in my work on this group, I have carefully reviewed the species of the world for clues to their true phyletic relations; from this study I envisage a different and, I hope, more natural classification of the caenid mayflies.

The scope of this revision demanded, of course, that a series of specimens from across the continents be obtained. To that end, I am deeply indebted to the many ephemeropterists and institutions who loaned or donated material of this family to me. They are: the Academy of Natural Sciences of Philadelphia; the American Museum of Natural History; Dr. Lewis Berner of the University of Florida; the Canadian National Collection; Dr. Henry Dietrich of Cornell University; Mr. R. S. Crass of the Natal Parks, Game and Fish Preservation Board; Dr. George F. Edmunds, Jr., of the University of Utah; Dr. M. T. Gillies of the East African Malaria Unit; the Illinois Natural History Survey; Dr. Josette F. Lafon of the University of Lyon; the University of Nebraska; the University of Pennsylvania; Dr. J. R. Traver of the University of Massachusetts. Also, I would like to extend special thanks to the following persons: to the Davenport Public Museum, Davenport, Iowa, for support of parts of this project; to Dr. Jay R. Traver, for data on type specimens in her collection and for many other favors which she performed so tirelessly; and last, to the members of the Faunistic Survey Division of the Illinois Natural History Survey, who kindly provided the laboratory facilities used for most of the work and who also gave me many helpful suggestions and much useful advice throughout.

Historical and Present Classification

The family Caenidae as considered here consists of six genera: *Brachycercus* Curtis, *Caenis* Stephens, *Caenodes* Ulmer, *Austrocaenis* Barnard, *Tasmanocoenis* Lestage, and *Caenomedea*, a new genus described below. It was erected as the tribe Caenini by Banks in 1900 and, according to the Copenhagen decisions of the International Commission on Zoological Nomenclature, Banks should be credited with the authorship of the family. Moreover, until 1942 the various tricorythid genera were considered to be part of this family. At that time, however, Lestage showed convincingly that the caenid and tricorythid genera had evolved separately and so erected the family Tricorythidae for the latter.

Brachycercus was the first genus of the family to be described. It was erected by Curtis in 1834, with *B. harrisellus* Curtis as the type species. Until recently, the synonym *Eurycaenis* Bengtsson (1917) has been used by some workers. Next, the name *Caenis* was proposed by Stephens (1835) for the then newly described species *macrura*, which is its type species. It was unnecessarily renamed *Ordella* by Campion in 1923. In addition, these two genera were lumped and renamed *Oxycypha* by Burmeister in 1839.

In 1924 Ulmer redescribed what he believed to be *Caenis cibaria* Eaton and at once separated it from the remaining species of *Caenis* as the genus *Caenodes* on the basis of the ratios of the foreleg segments. Kimmins (1949) later demonstrated that *cibaria* was entirely different from the species described by Ulmer under that name and so renamed the latter *Caenodes ulmeri*. Then, in 1930, Lestage erected the genus *Tasmanocoenis* for the newly described species *tonnoiri*. *Austrocaenis* was described by Barnard in 1932 for his heretofore unknown species, *capensis*.

The most recent review of the present classification was presented by Demoulin (1955*a*). The characters he used are as follows:

Prosternum broader than long; fore coxae widely separated.
  Brachycercus—antennal pedicle three times the length of the scape.
  Austrocaenis—antennal pedicle twice the length of the scape.
Prosternum longer than broad; fore coxae nearly contiguous.
  Forelegs of ♂ only slightly longer than the hindlegs.

Caenodes—forefemur of ♂ 4/5–5/6 the length of the foretibia, which is only slightly longer than the foretarsi.

Forelegs of ♂ at least twice as long as the hindlegs.

Caenis—foretibia of ♂ longer than foretarsi.

Tasmanocoenis—foretibia of ♂ equal to or shorter than the foretarsi.

The points of confusion in this present system of classification are two in number. First, as can easily be seen from Table I, considerable gradation of the ratios of the various leg segments is present within the known species; obviously, the characters which have been used in the past are arbitrary, representing the extreme conditions, and so are not valid criteria for genera. As Kimmins (1956) has already pointed out, *Caenis brevipes* fairly well invalidates the genus *Caenodes* as it now stands. Moreover, *Caenis nigropunctata, C. cibaria,* and all of the known Nearctic species seem to lie as close to *Tasmanocoenis* as to *Caenis* in regards to the fore leg/hind leg ratio, while *Caenis valentinae* would almost be placed in *Tasmanocoenis* on the tibia/tarsus ratio alone.

Second, there is a wide variety of genitalic types in each of the genera as they now exist. Van Bruggen (1957) has pointed this out for *Tasmanocoenis.* It can be said for the others as correctly. As these structures along with the wings and forelegs are most important in the brief life of the adult mayflies, during which their only activity of consequence is mating, one would assume that the genitalia would be subject to discreet selection. Therefore, one would expect the types of genitalia to be important taxonomically in this group and not randomly distributed under various generic names.

Taxonomic Characters

The caenid mayflies present a combination of structures which are remarkable for their extreme reduction to a simple functional form. These ephemerids have lost their hind wings entirely, reduced and modified their venation to the sculling type of flight, greatly enlarged the thorax while foreshortening the abdomen, and, in part, reduced the genitalia to the bare essentials. All of these modifications may be said to be specializations, for they are found in many other specialized genera to some degree, e.g.

Table I.

Ratios of Leg Segments in Three Genera of Caenidae [1]

Genus	Class	Foreleg/Hindleg Range Min.	Max.	Mean	Diff.	Forefemur/Foretibia Range Min.	Max.	Mean	Diff.	Foretibia/Foretarsus Range Min.	Max.	Mean	Diff.
Caenodes	old	1.00	1.12	1.06	0.14	0.83	1.17	1.00	0.29	1.28	1.35	1.32	0.09
	new	1.00	1.41	1.20		0.47	1.17	0.71		1.25	1.64	1.23	
Caenis	old	1.27	2.80	1.78	0.25	0.33	0.66	0.50	0.03	1.09	1.82	1.51	0.00
	new	1.55	2.80	2.03		0.33	0.65	0.57		1.09	1.82	1.51	
Caenomedea	new	1.36	2.08	1.98	—	0.48	0.66	0.59	—	1.13	1.75	1.38	—

[1] Data from published sources and from personal observations of the author.

Baetis, Homoeneuria, Isca, etc. The nymphs, which have elytroid gill covers, appear to be adapted to inhabit a wide variety of aquatic conditions, especially those of turbid water where the majority of ephemerid groups would fail. The next problem, then, is to determine the taxonomic significance of each of the structures found in this family.

Penis lobes.—Snodgrass (1957) has recently published a revised interpretation of the evolution of the male genitalia of insects. In this hypothesis, the penis lobes arose as two simple out-pocketings from the tenth segment. The penis lobes of the mayflies are cited as examples of this primitive condition. Within the family Caenidae, two extremes with various intergradations can be found. Based on the Snodgrass hypothesis, the primitive extreme (fig. 1, A and B) would be that type which has the lobes

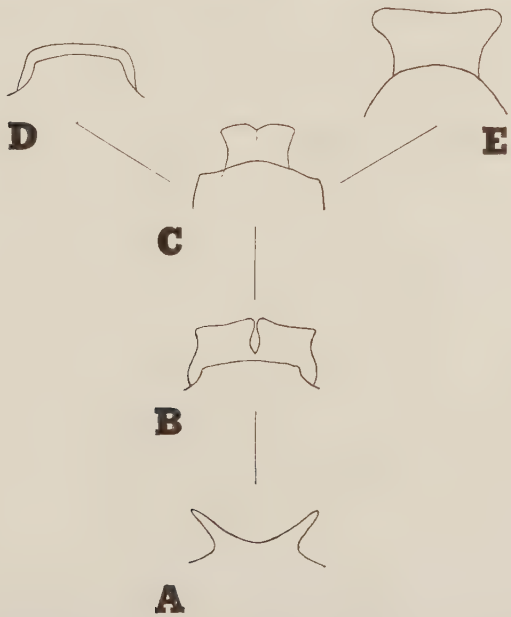

Fig. 1. The basic trend in the evolution of the penis lobes as seen in the genus Caenis (revised). The species are: A = *C. scotti;* B = *C. macrura;* C = *C. jocosa;* D = *C. edwardsi;* E = *C. robusta.*

almost entirely separated, while the derived extreme would be the one which has them entirely fused (fig. 1, D and E). The Nearctic species (fig. 1, C) represent an intermediate stage. Also, within the cases of the derived extreme, i.e. the two lobes fused, there are two conditions present—the penis lobes are longer than broad or broader than long. As the lobes of the primitive extreme are longer than broad, I am considering those with this condition to be the primitive ones and the others to be the secondary. The penis lobes, then, appear to reflect stages that existed in the evolution of these structures and therefore are important taxonomically as well.

Forceps.—There are five main forms of forceps in this group: barbed, as in *Caenodes ulmeri* (fig. 2, A); tufted, as in *Austro-*

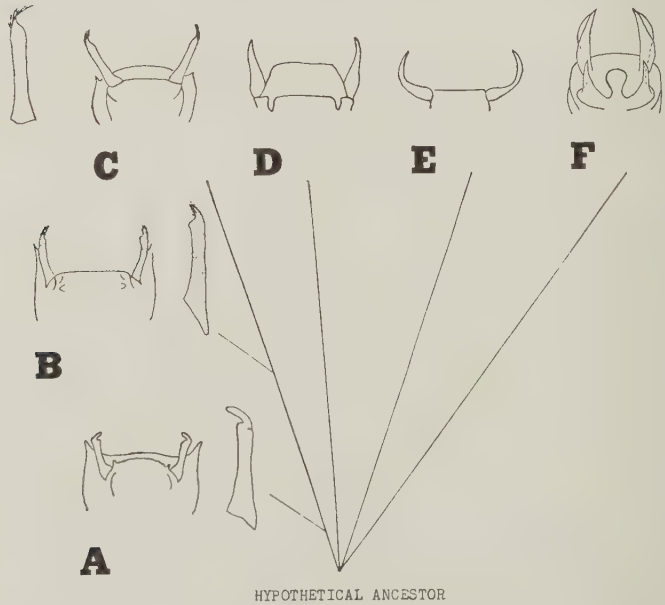

Fig. 2. The basic trends in the evolution of the forceps of caenid mayflies. The species represented are as follows (revised classification): A = *Caenodes hoggariensis;* B = *Caenodes felsinea;* C = *Caenomedea kivensis;* D = *Caenis hilaris;* E = *Tasmanocoenis tonnoiri;* F = *Brachycercus prudens.*

caenis capensis (fig. 2, C); blunt, as in *Caenis macrura* (fig. 2, D); bowed, as in *Tasmanocoenis tonnoiri* (fig. 2, E); and grooved, as in *Brachycercus harrisellus* (fig. 2, F). This variety in the form of the forceps within a single family is almost without parallel in the order, for in most other families the forceps vary but little. Thus, to analyze a situation such as this is difficult, as there is no supporting evidence from the rest of the order.

This is what I believe has happened. First, one must determine whether the caenid forceps are basically primitive or specialized in form. Spieth (1933) in his study of the phylogeny of some of the mayfly genera concluded that the forceps of mayflies were originally one-segmented. Snodgrass (1957) agrees with this in his reinterpretation of these structures. Since all of the forceps of the caenid genera are one-segmented, one might suspect that this represents a primitive condition. I do not feel that this is the case, however, for the following reasons. Foremost, the evidence of Spieth and Snodgrass consists primarily of ontological and comparative anatomical findings in the orthopteroid insects. It does not take into consideration the limited, but valuable knowledge of fossil forms which is now available. In all fossil species which appear to have been ancestral or close to the ancestors of the true Ephemeroptera, the imagal forceps are multi-segmented. I cite the examples of *Cronicus, Electrogenia, Protereisma, Triplosoba,* and *Hexagenites* (Carpenter 1933, Demoulin 1955*b* and *c*, 1956*a* and *b*). In addition, there are other genera in the order which have one-segmented forceps, e.g. *Homoeneuria, Behningia,* etc., and which are certainly specialized, thereby showing that in these cases the one-segmented condition is a derived one. Thus, I believe that the evidence given by earlier workers shows a very early condition commonly ancestral to the orthopteroid orders as a whole and persistent in the mayflies ontologically. I also believe, however, that by the time the mayflies arose as a specific group, the imagal forceps were fully segmented, and that all primitive mayflies have continued to show such a condition. In this manner, the paleontological and anatomical evidence can be made compatible. If this be the case, one must conclude that the one-segmented condition of the caenid forceps is a derived or specialized condition.

Second, one must consider the adaptation of the five forms of forceps mentioned above. From available evidence on mayfly reproduction, it appears that the forceps function only to hold the female during copulation. Theoretically, then, the blunt condition as well as the barbed, tufted, grooved, and bowed conditions arose under selective pressure designed to improve the function of this organ. I can offer no proof of this statement, but it is the only explanation that appears likely to me. Since there appears to be a variety of adaptive forms in this structure, the function of which is vital to the existence of the species, one would thus assume that the forceps have been involved in important evolutionary changes in the group and would be important taxonomically, also.

And last, the trend in the evolution of these forms must be determined. The evidence here is scanty. It is possible that the barbed condition represents a reduced two-segmented condition with the long proximal segment being the first and the barb the second. Also, the tufted condition may have arisen from the barbed type, for the forceps of *C. felsinea* are barbed and at the same time bear small spines (fig. 2, B). The foiled, bowed, and blunt conditions probably arose independently, however, as no integrating forms are known or even logically conceivable.

In summary, then, it is considered here that the five forms of forceps are derived or specialized conditions which have largely arisen as separate trends in the process of adaptation to the same function. Such major evolutionary changes invite taxonomic recognition.

Ratios of the leg segments.—As shown above, the ratios exhibit a wide range of variation and therefore are not reliable taxonomic criteria. In regards to the reduction of the length of the forelegs, I believe that this is the derived extreme, as it is found in other specialized genera, e.g. *Binoculus*, while the hypertrophied condition is normal to the order in general, including most primitive genera. As to the other ratios, little can be said as their functional significance is not yet understood.

Prosternum.—The genera *Austrocaenis* and *Brachycercus* both have the prosternum broader than long with the fore coxae widely separated, while the condition basically found in the order

is the opposite one. Thus, the forms of the prosternum in these two genera probably arose in the process of fore-shortening the thorax and is a derived one. I would tend to accept this condition as a rather broad and important one, becoming fixed early in the reduction of a phyletic line.

Venation.—The forewings of the caenid mayflies are obviously specialized by the process of reduction. As it is often the case that where a structure is reduced or somewhat vestigial there is a considerable amount of variation, I have considered it unwise to use the small differences existing between genera and species as reliable characteristics.

Nymphal characters.—Unfortunately, very little work has been done on the nymphs of this family up to this time. The European species are the best known, but still only in part. For the rest of the world fauna, only scattered descriptions, often incomplete, are available. Through the kindness of Dr. R. C. Crass and Dr. L. Berner, I have been able to examine a great number of reared nymphs heretofore unknown. From this material, I have been able to draw a description of the nymph of at least one species for each genus. In this work, the forms of the pronotum, gills, gill covers, and mouthparts have all proved to be useful characters, just as they have in the limited fauna studied by Macan (1955) and Kimmins (1943). Until such a time when more details are known, however, one can only utilize the small knowledge of the nymphal forms now available as a check on the conclusions drawn from the imagoes. This is the procedure used in this work.

Patterns of Evolution

The concept has now been presented that the forms of the penis lobes and forceps are important and specific taxonomic characters; that the form of the prosternum is a broad, but significant character; that the ratios of the leg segments and the venation are less significant ones; and that the nymphal characters are not well enough known to be of immediate use. The task now is to arrange these characters into generic patterns which are at once both natural and practical and which are the results of the evolution of these mayflies.

As the penis lobes and forceps appear to have been involved in basic changes in the evolution of the Caenidae, I believe that any classification must take these two structures into consideration above all others. There are two possible patterns that can be formed with the different types of these organs. First, one can group those species with similar penis lobes together. On the other hand, the species may be grouped according to the form of the forceps. I believe that this latter way is correct for the following reasons.

As was pointed out above, the forceps in most ephemerids do not appear to have undergone intense selection. They seem to have evolved in a much broader manner than have the penis lobes, which are usually distinct for each species. If the species are grouped according to the form of the penis lobes, i.e. the first possibility, there will be several different kinds of forceps in each genus. One would hardly expect, however, that the same type of forceps would be evolved randomly among certain species of

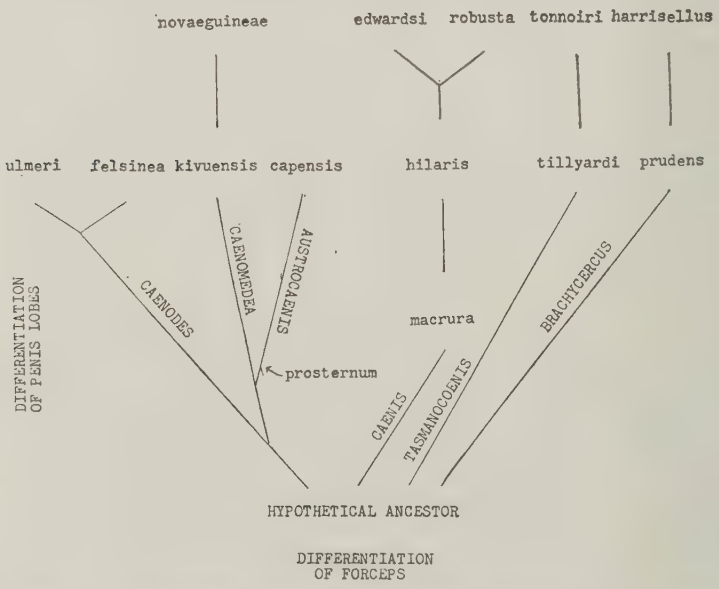

Fig. 3. A phylogenetic diagram of the revised classification of the caenid mayflies as explained in the text.

several genera, if this structure is indeed of such importance to the reproductive functions as is assumed here. Moreover, the groups would not be practical, for the boundaries between the different types of penis lobes are graded and indistinct.

If the species are arranged according to the form of the forceps, however, patterns which are both theoretically probable and also practical are formed (fig. 3). In this manner, the importance of the form of the forceps is given full weight, and the resultant groups are very distinct. Also, the different forms of the penis lobes can be arranged within each group from the primitive extreme to the derived condition. Thus, it appears to me that the caenid mayflies which have a common form of forceps also have had a common ancestry and that this was in the distant past. As a result, the genera now existing have some members with rather primitive penis lobes while others in each group have evolved the more specialized fused condition. In addition, the form of the prosternum and what is now known of the nymphal characters fit well into such a scheme, as is shown below. The ratios of the leg segments are not much affected (Table I), thereby showing the uselessness of this character. These are the reasons on which this new classification of the caenid mayflies is based.

Key to the Genera

Imagoes

1. Base of male genitalia with two short spines; forceps foil-like, with median depression (fig. 2, F). Prosternum broader than long *Brachycercus*
   Base of male genitalia without spines; forceps more cylindrical and without median depression. Prosternum longer than broad (except *Austrocaenis*) 2
2. Male forceps with single, stout barb at tip (fig. 2, A and B) *Caenodes*
   Male forceps blunt, tufted, or bowed, without barb at tip 3
3. Male forceps with tuft of spine-like bristles at tip (fig. 2, C) 4
   Male forceps lacking such a tuft of bristles 5
4. Prosternum longer than broad, with the fore coxae nearly contiguous *Caenomedea*
   Prosternum broader than long, with the fore coxae widely separated *Austrocaenis*
5. Male forceps straight and blunt or pointed; not bowed (fig. 2, D) *Caenis*
   Male forceps strongly bowed (fig. 2, E) ..... *Tasmanocoenis*

Nymphs

1. Head with prominent median and smaller lateral tubercles bearing ocelli. Maxillary and labial palpi 2-segmented ..... *Brachycercus*
   Head lacking such tubercles. Maxillary and labial palpi 3-segmented .. 2
2. Gill covers with triangular ridge on dorsum and with marginal fringe of hairs. First gill 2-segmented; lamellate gills with fringe multifid 3
   Gill covers without triangular ridge and without marginal fringe of hairs. First gill 3- or 4-segmented; lamellate gills with fringe single or bifid. Mandible without marginal tufts of hairs; labrum narrowly emarginate and without marginal fringe of hairs .... *Tasmanocoenis*
3. Mandibles with marginal hairs on one or both sides 4
   Mandibles without marginal hairs or at most with few apical hairs on lateral side 5
4. Labrum usually narrowly, sometimes broadly, emarginate. Gill covers with large spines on mesal fork of triangular ridge; without row of submarginal spines. Tarsal claws usually with 4–5 minute spines basally ..... *Caenodes*
   Labrum broadly emarginate. Gill covers lacking such spines on ridge, but with row of minute submarginal spines. Tarsal claws without basal spines ..... *Caenis*
5. Distal segment of labial palpi much smaller than second. Gill covers without row of minute submarginal spines. Tarsal claws broad and hooked. Prosternum broader than long, with fore coxae widely separated ..... *Austrocaenis*
   Distal segment of labial palpi smaller than second. Gill covers with row of submarginal minute spines. Tarsal claws long and slender, not hooked. Prosternum longer than broad, with fore coxae nearly contiguous ..... *Caenomedea*

In the following sections, it will be noted that each genus is generally divided into several complexes. Keys to these complexes have not been included, but they conform to the form of the penis lobes as shown in fig. 1 and diagrammed in fig. 3. I intend to treat them more specifically in subsequent papers.

Genus **CAENODES** Ulmer

Caenodes Ulmer 1924: 7.

Type species.—*C. ulmeri* Kimmins.

Imago.—Male forceps with terminal barb, without tuft of spines, though it may be finely hirsute (*C. felsinea*); not bowed or grooved. Penis lobes fused basally, but with median indentation apically, as in the *hilaris* section of *Caenis*. Prosternum longer than broad with fore coxae nearly contiguous.

Nymph.—Head without tubercles. Mandibles with lateral margins fringed with long hairs; lateral canine with 3–5 teeth, mesal one with 2–3. Maxillary palpi 3-segmented, hirsute. Labium hirsute, with palpi 3-segmented; distal segment small, about one-fourth length of second. Labrum hirsute, either narrowly or broadly emarginate medially. Gill covers with triangular ridge, the mesal fork of which bears long spines; marginal fringe of hairs present, but not submarginal spines. Lamellate gills with fringe multifid. Tarsal claws small, broad, and hooked and with 4–6 minute basal spines.

Components.—*C. felsinea* (Grandi), **comb. nov.**; *C. hoggariensis* (Grandi), **comb. nov.**; *C. jinjana* Kimmins; *C. kungu* (Eaton), **comb. nov.**; *C. nigropunctata* (Ulmer), **comb. nov.**; *C. ulmeri* Kimmins.

Distribution.—Primarily African; also from Italy, China, Java, Sumatra, and Bali.

Discussion.—The single form of the penis lobes present in the genus, which is intermediate on the evolutionary scale, as well as the distinct type of forceps, make this genus a well defined unit.

Genus **CAENOMEDEA** gen. nov.

Type species.—*C. kivuensis* (Demoulin), **comb. nov.**

Imago.—Male forceps with terminal tuft of spines, without terminal barb; not bowed or grooved. Penis lobes either fused basally and with apical indentation or completely fused. Prosternum longer than broad, with fore coxae nearly contiguous.

Nymph.—Head without tubercles. Mandibles lacking marginal fringe of hairs except for a few bristles on the lateral apical angle; right lateral canine with 3 teeth, mesal one with 2; left lateral canine with 4–5 teeth, mesal one with 3. Labium hirsute, palpi 3-segmented; distal segment small, about one-fourth of second. Labrum hirsute, broadly emarginate medially. Gill covers with triangular ridge, which bears long spines; marginal fringe of hairs and submarginal spines present; margins per se hyaline. First gill 2–3 segmented; lamellate gills with fringe multifid. Tarsal claws long, slender, and straight. Posternum longer than broad, with fore coxae nearly contiguous.

Components.—This new genus may be divided into two sections: *kivuensis* complex: *C. brevipes* (Kimmins), **comb. nov.**; *C. cibaria* (Eaton), **comb. nov.**; *C. kivuensis* (Demoulin). *novaeguineae* complex: *C. novaeguineae* (van Bruggen), **comb. nov.**

Distribution.—Africa; New Guinea.

Discussion.—I am erecting this new genus to account for what I believe has been one of the major phyletic lines in the family.

On the basis of forceps form alone, this group would be included within the genus *Austrocaenis*. However, the condition of the prosternum in the latter points to an early and separate origin. Indeed, *Caenomedea* and *Austrocaenis* may have had a common origin, being separated by "splitting", or they may have had separate origins and then evolved convergently in regards to the forceps type. No matter, they are separate and distinct units which merit generic rank. The nymphal characters support this conclusion.

Genus **AUSTROCAENIS** Barnard

Austrocaenis Barnard 1932: 227.

Type species.—*A. capensis* Barnard.

Imago.—Male forceps with terminal tuft of spines, without terminal barb; not bowed or grooved. Penis lobes fused basally, but separate apically. Prosternum broader than long, with fore coxae widely separated.

Nymph.—Head without tubercles. Mandibles lacking marginal fringe on both sides; lateral canine with 3 teeth, mesal one with 2. Maxially palpi 3-segmented. Labium hirsute, with palpi 3-segmented; distal segment large, about one-half of second. Labrum hirsute, broadly emarginate medially. Gill covers with triangular ridge, which bears spines; marginal fringe of hairs present, but lacking submarginal spines and hyaline margin. Lamellate gills with fringe multifid. Tarsal claws small, broad, and hooked. Prosternum broader than long, with fore coxae widely separated.

Compenent.—*A. capensis* Barnard.

Distribution.—Entirely African.

Genus **CAENIS** Stephens

Caenis Stephens 1835: 61.
Oxycypha Burmeister 1839: 796, in part.
Ordella Campion 1923: 518, new name unnecessarily proposed.

Type species.—*C. macrura* Stephens.

Imago.—Male forceps pointed or blunt, without terminal barb or tuft of spines; not bowed or grooved; longer or shorter than penis lobes. Penis lobes variable, from totally separate to completely fused. Prosternum longer than broad (though it may be almost as broad as long in some of the larger species, e.g. *C. simulans*), with fore coxae nearly contiguous.

Nymph.—Head without tubercles. Mandibles with lateral margins fringed with long hairs; lateral canine with 3 teeth, mesal one with 2. Maxillary palpi 3-segmented. Labium hirsute, with palpi 3-segmented; distal segment small, about one-fourth of second. Labrum hirsute, broadly

emarginate medially. Gill covers with triangular ridge, which lacks spines; marginal fringe and submarginal spines present. Lamellate gills with fringe multifid. Tarsal claws small, broad, and hooked and without minute basal spines.

Components.—This large genus may be divided into four sections based on the penis lobes (figs. 1 and 3): *macrura* complex: *C. berneri* Kimmins; *C. macrura* Stephens; *C. moesta* Bengtsson; *C. rivulorum* Eaton; *C. scotti* Ulmer. *hilaris* complex: *C. amica* Hagen; *C. anceps* Traver; *C. delicata* Traver; *C. diminuta* Walker; *C. forcipata* McD.; *C. gigas* Burks; *C. hilaris* (Say); *C. jocosa* McD.; *C. latipennis* Banks; *C. nivea* Bengtsson; *C. punctata* McD.; *C. ridens* McD.; *C. simulans* McD.; *C. tardata* Traver; *C. undosa* Tiensuu. *robusta* complex: *C. horaria* (Linn.); *C. lactea* Pictet; *C. robusta* Eaton. *edwardsi* complex: *C. edwardsi* Kimmins; *C. fennica* Aro; *C. picea* Kimmins; *C. srinagari* Traver; *C. ulmeri* Brodsky; *C. valentinae* Grandi.

Distribution.—Worldwide.

Discussion.—The fact that this genus is distributed over the entire world shows that it is a highly successful competitive group. Within it are preserved species which, I think, show the evolution of the penis lobes quite clearly. The species *C. scotti* Ulmer has the lobes widely separated and therefore appears to be the most primitive member of the genus. All of the other species which are included with it in the *macrura* complex have the same basic form of penis, although several specializations are apparent. For example, *C. moesta* has developed simple ridges on each lobe, while *C. macrura* represents a condition which was probably ancestral to the first fusion of these structures.

The *hilaris* complex represents a condition in which the two lobes have fused basally, but still have an apical indentation to show their separate origin. It is interesting to note that this section includes all of the North American species.

Within the *robusta* and *edwardsi* complexes are found the specialized species of this genus. Here the penis lobes have completely fused, leaving no trace of their separate origins. The two conditions represented by these groups have been discussed above.

Genus **TASMANOCOENIS** Lestage

Tasmanocoenis Lestage 1930: 49.

Type species.—*T. tonnoiri* Lestage.

Imago.—Male forceps blunt and strongly bowed without terminal barb or tuft of spines. Penis lobes either fused basally and with apical indentation or completely fused. Prosternum longer than broad, with fore coxae nearly contiguous.

Nymph.—Head without tubercles. Mandibles lacking marginal fringe on both sides; canines with variable number of teeth (from 1–4). Maxilla with only a few hairs, no thick spines; palpi 3-segmented. Labium with few hairs; palpi 3-segmented, with distal segment small. Labrum lacking marginal fringe of hairs; narrowly emarginate. Gill covers lacking triangular ridge and marginal fringe and with only a few dorsal hairs. First gill 3–4 segmented; lamellate gills with fringe single or bifid.

Components.—*T. tillyardi* Lestage; *T. tonnoiri* Lestage.

Distribution.—Australia and Tasmania.

Discussion.—This group appears to be a highly specialized one restricted to the Australian region. The type species has been admirably reviewed by Demoulin (1955*a*).

Genus **BRACHYCERCUS** Curtis

Brachycercus Curtis 1834: 122.
Oxycypha Burmeister 1839: 796, in part.
Eurycaenis Bengtsson 1917: 186, new name unnecessarily proposed.

Type species.—*B. harrisellus* Curtis.

Imago.—Male forceps foil-like, with median depression; without terminal barb or tuft of spines; not bowed. Base of genitalia with two short spines (fig. 2, F). Penis lobes either fused basally and with apical indentation or completely fused. Prosternum broader than long, with fore coxae widely separated.

Nymph.—Head with prominent median tubercle and with lateral tubercles bearing ocelli. Maxillary and labial plapi 2-segmented. Prosternum broader than long, with fore coxae widely separated. Tarsal claws long and slender, not toothed.

Components.—*B. flavus* Traver; *B. harrisellus* Curtis; *B. lacustris* (Needham); *B. maculatus* Berner; *B. magnus* Tshernova; *B. minutus* Tshernova; *B. nitidus* (Traver); *B. prudens* (McD.); *B. tenella* (Navas); *B. tubulatus* Tshernova.

Distribution.—Europe and North America; very questionably Argentina.

Discussion.—This genus seems to be quite far removed from the other caenid mayflies, both by the peculiar type of genitalia and also the two-segmented condition of the palpi. Although the species could be broken down into complexes, I have refrained from doing so, as the genus is very poorly known. The species *B. tenella* (Navas), on which the record in Argentina is based, may not belong here. Its generic placement awaits confirmation after examination of the type.

Conclusion

It will be noted by anyone familiar with this family that many described species have been neglected in this paper. This is because the genitalia of these species have never been figured in the literature, thereby making them impossible to place in the new classification. They are best kept in their original genera until they can be accurately placed.

Moreover, I have in preparation several papers treating these same species and others in a more detailed fashion. Here will be discussed problems encountered on the species level, as well as those derived from the ecological data of the group.

The new classification which has just been described appears to fit the criteria set forth earlier—it appears to be both meaningful and practical. Whether it shall stand up to future examination is a most intriguing question, which can only be answered in due time. I can only point out that the imagoes have been thoroughly examined, so that new data from this stage is likely to come only from new forms which one always hopes may be discovered, or from studies on the internal anatomy. The nymphs present a different and more promising picture. Here numerous facts on which this classification or any other must be based lay buried. It is hoped that the present work will kindle the interest and enthusiasm of workers for these problems.

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THE LARVAL MORPHOLOGY OF SOME TACHINID PARASITES OF DIATRAEA (DIPTERA)

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The caterpillars of certain species of the Pyralid genus *Diatraea* are perhaps the most consistently injurious pests of sugar-cane in the Western hemisphere. As chemical control is difficult and satisfactory "resistant" or "immune" varieties of cane have not been developed, much attention has been devoted to the natural enemies of *Diatraea* in the hope of obtaining biological control. In Barbados, for many years, the egg parasite *Trichogramma* was artificially bred and liberated annually in large numbers. The practical value of this work has been seriously contested. On the other hand, the introduction of some of the Tachinid parasites of *Diatraea* into infested areas where they were absent, appears, in some cases at least, to have resulted in a reduction of damage. H. E. Box, J. G. Myers, F. J. Simmonds and many other entomologists have written extensively on this subject, which I have no space to review here.

Experience suggests that in assessing the results of such work, a detailed knowledge of the early stages of the parasites concerned is useful. In fact, the most accurate information about the fate of introduced parasites and about their interrelations is that obtained by dissection of the host insects and to interpret the results of such work it is necessary to identify the parasites in all of the larval stages. Some descriptions of the larvae and puparia of the Tachinid parasites of *Diatraea* have been published (cf. Box, 1952, Parker, 1953, Scaramuzza, 1930, Townsend, 1936–1941), but they are either inaccurate or incomplete even though in some cases they are useful to the field worker.

During the winter of 1959–60, the writer and his wife spent several months in Trinidad, continuing and extending work on the Tachinid fauna of the island. With the help of Mr. F. D. Bennett and his assistants, material of the four Tachinid parasites of *Diatraea* now being bred in the laboratory of the Commonwealth Institute of Biological Control, was assembled and

used as a basis for the present paper, which covers the larval forms of *Lixophaga diatraeae* T.T., *Metagonistylum minense* T.T., *Paratheresia claripalpis* v.d.W. and *Stomatodexia diadema* Wd. Material of *Palpozenillia palpalis* Ald., of special interest because of its habit of depositing microtype eggs and, according to H. E. Box, of great potential value, was not available.

Since the group of Tachinids attacking *Diatraea* is very small, it does not seem necessary in this paper to give descriptions of the adults. However, for convenience, the following simple key, which also includes *Palpozenillia*, has been prepared.

1. Prosternum bare; last abdominal segment without discal bristles; arista long or short plumose 2
   Prosternum bristled; last abdominal segment with discal bristles; arista bare 3
2. First abdominal segment excavated to border; cruciate apical scutellars present; propleura setose; legs black, short and stout; arista long plumose; thorax grey with three broad black stripes (Fig. 31, head) *Paratheresia claripalpis* v.d.W.
   First abdominal segment not excavated to border; no cruciate apical scutellars; propleura bare; legs markedly elongate and slender; arista short plumose; thorax, scutellum, abdomen, legs except the tarsi, usually yellow, the thorax sometimes greyish with small vittae but without broad black stripes (Fig. 26, head) *Stomatodexia diadema* Wied.
3. Parafrontals and parafacials black, shining, front flat above, strongly protruding, the distance from base of antenna to eye margin about equal to diameter of eye; first antennal joint erect, elongate, about as long as second; first aristal joint elongate, second about two and one-half times first, third strongly thickened almost to tip (Fig. 9, head) ..... *Metagonistylum minense* T.T.
   Parafrontals and parafacials densely pollinose, front not markedly protruding, arista thickened only on basal portion 4
4. First posterior supra-alar markedly shorter than following bristles and dorso-centrals; three post-sutural bristles; no discals on intermediate segments, female with normal palpi (Fig. 2, head) *Lixophaga diatraeae* T.T.
   First posterior supra-alar not markedly shorter than following bristles and dorso-centrals; four post-sutural bristles; three sterno-pleural bristles; discals on intermediate segments; female with a deep pit on the upper side of each palpus ..... *Palpozenillia palpalis* Ald.

Lixophaga diatraeae T.T.

Stage I.—(Length, 0.99 mm.; width, 0.27 mm.)

The first stage larva has been described as having no integumental spines and as having paired mandibular sclerites such as occur in the primary larva of *Sarcophaga* and in the second and third stages of Tachinids (Scaramuzza, 1930). In fact, the primary larva of *Lixophaga* has well developed spine bands and the usual unpaired median mandibular sclerite. Lateral sclerites, which are the homologues of the paired mandibular sclerites of stages II and III, are present, but these are normally present in primary Tachinid larvae and could hardly be confused with the true paired mandibular sclerites. It is possible that a small Stage II larva was mistaken for Stage I.

Cuticule transparent and colorless, with anterior spine bands that are complete on the thoracic segments, but interrupted dorsally on the first seven abdominal segments. A complete posterior band encircles the seventh segment.

Head or pseudocephalon bearing on each side on an oval base, a slightly convex antennal organ (Fig. 3) and a group of maxillary sensoria including two short clavate organs; segment I with an anterior band of four rows of narrow acute spines on the dorsal half, expanding abruptly into a band of nine or ten rows on the ventral half; behind the middle of the dorsal band a few additional small spines; segment II with a broad anterior band with about eight rows ventrally and ten rows laterally; this band divides near the dorso-pleural line into an anterior band of about six rows and a posterior band which tapers abruptly and consists of only two rows, crossing the dorsum; segment III with a complete undivided anterior band of about nine rows ventrally, twelve rows laterally and five rows dorsally; segment IV with an irregular anterior band of two to four rows, narrowing dorsally where it is interrupted; on segments V, VI, VII and VIII the band becomes progressively shorter but lengthens slightly on IX and more so on X while on XI it again encircles the segment. However, the direction of the spines indicates that this extension of what appear to be single bands is due to the appearance of spines on the posterior border of the segments, the anterior bands having diminished, while the posterior bands have broadened; the anterior bands can be recognized because the spines composing them point backward, while the spines of the posterior bands point forward; thus what appears to be a complete anterior band on segment XI is in reality a posterior band on segment X; on segment XI there is, first, a row of about six backwardly directed hooked spines on the dorsum and a short group comprising three or four rows of small flat spines across the ventral side, slightly in front of the posterior spiracles; finally, there is, some distance ventrad of the spiracles, a short heavy black plate (Fig. 6) with short paired recurved hooks at the dorsal end and another pair of acute but much shorter hooks half way between the terminal hooks and the base.

Respiratory system metapneustic, the posterior spiracles well developed, situated on the dorso-caudal surface, with slender "felt-chambers" about six times as long as broad (L., 0.035 mm.) (Fig. 6).

Buccopharyngeal armature (Fig. 1) about 0.133 in length from the anterior edge of the median tooth to the tip of the upper wing of the posterior region; anterior region consisting of a median unpaired sclerite, slightly convex dorsally, with the dorso-anterior angle distinct, slightly obtuse, the anterior edge almost perpendicular, feebly dentate along its upper three-fourths; ventrally, the sclerite terminates in a pale rounded apex, contrasting with the dark region above it; the cuticle around the tip appears to be thick and colorless or else the pale brown ventral tip is enclosed in a rounded cuticular pocket, the characteristic appearance, which is well shown in the figure, (Fig. 4) being difficult to interpret morphologically; the intermediate region to the anterior edge of the ventral wing of the posterior region, is slightly shorter then the anterior region; on each side of the latero-ventral area of the intermediate sclerite, is a small pale circular spot bearing a sensorial organ; the ventral wing of the posterior region is shorter than the dorsal wing; the lateral anterior plates are well-marked, strongly pigmented as is the sclerite of the salivary gland; in the middle of the ventral side of the latter is a pale cordiform area with the apex directed forward.

Stage II.—(Length (about middle of stage) 2.7 mm.; width, 0.85 mm.)

Cuticle colorless with rather broad bands of spines on the anterior and posterior regions, less conspicuous on the middle of the body.

Head with well-marked but only slightly convex antennal organ and the usual group of maxillary sensoria; segment I with a dorsal band of five or six rows of rather short acute pale spines, the band broadening in the ventral region, where there are eleven or twelve rows; segment II with a similar anterior band of six or seven rows dorsally, three or four rows laterally and eight or nine rows ventrally, also some scattered spines across the middle of the segment, these directed forward while the spines of the true anterior row are directed backward; segment III with about four rows of acute spines dorsally, similar, less regularly spaced rows laterally, six or seven rows ventrally; segment IV with an inconspicuous anterior band of small spines in three or four rows; two or three similar rows of small anteriorly directed spines toward the posterior border of the segment; segments V and VI similar, with only a few rows of pale small spines but on VII there is a posterior band of stronger and darker spines, most conspicuous in the ventral region; segment VIII with only a few rows of small spines, backwardly directed on the anterior region but five to seven rows of larger and darker spines, directed forward, on the posterior border; segment IX with two or three irregular anterior rows of small weak spines on the pleural region, four or five rows on the ventral region; five to seven rows of stronger, anteriorly directed spines, on the posterior margin, the band broadening ventrally; segment X with some weak, backwardly directed spines on the lateral regions, the band broadening ventrally; a broad

band of forwardly directed, moderately strong spines on the posterior border; segment XI with no anterior spine bands but with a ring, comprising four or five rows of forwardly directed spines around a bare caudal area bearing the posterior spiracles.

Respiratory system metapneustic as in stage I; posterior spiracles (Fig. 5) well developed, each with two respiratory openings, the felt-chambers (L., 0.07 mm.) short, stout, about two times as long as wide.

Buccopharyngeal armature short and stout (L., 0.246 mm.) (Fig. 13), characterized by the relatively large, curved, acute mandibular sclerites which are only a little shorter than the intermediate and posterior regions combined; each mandible with a stout, obliquely truncate ventral process and a stout dorsal process, arising just behind the base of the mandible; intermediate region very short, the sclerite of the salivary gland well developed, extending ventrally below the level of the ventral wing of the posterior region, which is short and stout, truncate behind, the interval between the dorsal and ventral wings rounded, the dorsal wing slightly longer than the ventral wing, its antero-dorsal angle slightly produced.

Stage III.—(Length, 7–8 mm.; width, 3 mm.)

The larva is characterized by its small, slightly protruding anterior spiracles, bearing only six or seven respiratory papillae, arranged in an arc; and by the small posterior spiracles, separated by about one-half the diameter of one of them and showing, on a colorless area within a black peritreme, interrupted on the inner side, three short straight slits.

Head with the usual minute, slightly convex antennal organ and the maxillary sensoria, but without spines; segment I with one or two rows of fine spines on the anterior border, broadening to four or five rows ventrally; segment II with an anterior spine band of five or six rows, broadening ventrally to eight or nine rows, the spines short, triangular, acute, arranged in curving lines; segment III with a similar anterior band of five or six rows, encircling the segment; a small ventral row of spines on the posterior border; segment IV with an anterior band of four or five rows, slightly broader ventrally; a posterior band of one or two rows reduced to a single row pleurally and dorsally; segments V–IX very similar, the anterior band on IX with three or four rows dorsally and ventrally, the posterior band with three or four rows; segment X without an anterior band dorsally but with two or three rows on the pleural region and four or five ventrally; a posterior band of four or five rows encircling the segment; segment XI without a distinct anterior dorsal band but with some rows of spines on the ventral anterior border, extending to the anal plate; a ventral row also between the anterior band and the posterior extremity.

Respiratory system amphipneustic, the anterior spiracles (Fig. 16) slightly protruding, (Diameter, 0.08 mm.) carrying six or seven respiratory papillae arranged in an arc along the inner side; posterior spiracles (Fig. 22) (Diameter, 0.13 mm.) approximately circular, separated by about one-half of their diameter, each with a narrow black peritreme broadly interrupted on the inner side and surrounding a clear area bearing three

short straight slits, the middle slit distinctly shorter than the others.

Buccopharyngeal armature (L., 0.30 mm.) (Fig. 12) rather short and stout, the paired hooks extending almost straight forward, but curving slightly toward their acute tips, with a dorsal backwardly directed process and a broad triangular ventral process at the base which seems to be fused with the intermediate region; intermediate region narrowed behind the junction with the anterior tooth, but markedly expanding at its posterior end where it is separated from the posterior region; anterior and intermediate regions together slightly shorter than the posterior region; dorsal wing broad, extending well beyond the ventral wing; upper and lower edges of the intra-alar space almost parallel.

Metagonistylum minense T.T.

Stage I.—(Length, 0.66 mm.; width, 0.157 mm.)

Cuticle colorless with twelve conspicuous bands of small acute spines, a single additional row on segments I–III and an additional band on the venter of segment XI; head bearing only a rather broad but very slightly convex antennal organ (Fig. 23) and the usual maxillary sensoria; segment I with an anterior band, comprising seven rows ventrally, three rows laterally and three or four rows dorsally, the elements on the dorso-pleural areas longer than the others; from the border of the pleural area, a group of eight or nine spines projects backward and from this a rather irregular single row crosses the dorsum, half way between the anterior band and the posterior margin of the segment; segment II with a broad band of about seven rows encircling the anterior third of the segment and attached to this, in the pleural region, a roughly double row of small elements crossing the dorsum; segment III with an anterior band of five or six rows connected in the pleural area with a single row of a few elements crossing the dorsum; on the thoracic segments two pairs of small sensorial setae, each pair situated on a small rounded area, mark the insertion of the histoblasts of the imaginal legs; some circular and rod-like sensoria are also present but are mostly indistinct; segment IV with an anterior band of three or four rows on the anterior margin, a group of four or five small elements attached to it in the pleural area; segments V and VI with an anterior band of three or four rows in which a gap develops on segment VII; this gap widens on segments VIII and IX, the dorsal part of the band becoming weaker and on segment IX a dorsal row of feeble, forwardly directed elements appears on the posterior border; on segment X the anterior band practically disappears dorsally, while the posterior band, though composed of only one or two rows, becomes conspicuous, particularly in the ventral region; segment XI shows a short row near the anterior border in the ventro-pleural region, while another band, broadening at the middle to four or five rows, traverses the ventral area not far from the posterior end of the larva.

Respiratory system metapneustic, the posterior spiracles situated not far from the posterior extremity on the dorsal surface, with a pair of respiratory slits, the felt-chambers (Fig. 19) (L., 0.039 mm.) slender, about eight times as long as wide.

Buccopharyngeal armature elongate and slender (Fig. 8) (L., 0.086 mm.), characterized by the strongly curved acute median tooth (Fig. 11) obscurely striated and irregularly toothed on its anterior edge; length of the median tooth on its anterior border about one and one-half times the dorso-ventral breadth of the anterior region; anterior region from the dorso-anterior angle to the dorsal notch marking the junction with the intermediate region, about two and one-half times as long as the intermediate region, measured to the anterior edge of the ventral wing of the posterior region; ventral and dorsal wings of the posterior region well developed, separated by an area which is anteriorly acute; dorsal wing slender on its anterior two-thirds, enlarged posteriorly; anterior lateral sclerites well developed, roughly triangular; sclerite of the salivary gland also large with a pair of large oval unpigmented areas near the anterior edge.

Stage II.—(Length, 0.685 mm.; width, 0.114 mm.)

Cuticle colorless, the spine bands small and inconspicuous, but composed of curved acute elements; head with a pair of broad flattened antennal organs and the usual group of maxillary sensoria; segment I with a short ventral band on the anterior margin comprising about six elements; an irregular double row of backwardly directed elements on the posterior margin interrupted at the anterior spiracle; segment II with an irregular feeble row of minute forwardly directed elements on the anterior border, several similar rows on the posterior border; segment III with a few spines on the anterior border, several irregular rows, interrupted on the pleural area, posteriorly; segment IV with two or three rows on the anterior and posterior borders, encircling the segments; segments V, VI and VII similar, but the posterior bands become stronger while the anterior bands become weaker; on segment VIII the anterior band is weak, broadly interrupted pleurally; the posterior band similar; on segments IX and X the bands are still weaker and at the junction of X and XI very feeble and inconspicuous; no prominent spines or sensorial organs on segment XI.

Respiratory system amphipneustic; anterior spiracle feebly developed (Fig. 14), lying just at the junction of segments I and II; posterior spiracles rather large (Fig. 18) with two respiratory slits and broad short felt-chambers (L., 0.05 mm.).

Buccopharyngeal armature (L., 0.2 mm.) (Fig. 29) short and broad, the anterior and intermediate regions fused but with a partial joint partially filled up by pigmented cuticle between the intermediate and posterior regions; the paired mandibular sclerites directed forward, more or less truncate, irregular in form; dorsal wing of the posterior region broad, about two times as long as the ventral wing, intra-alar space with divergent margins, rounded anteriorly, an oval pale area on the ventral wing and a similar larger area on the dorsal wing.

Stage III.—(Length, 12.0 to 13.0 mm.; width, 3.0 mm.).

In this stage the larva can be recognized by the anterior spiracles, with thirteen to fifteen spiracular papillae, arranged in a ring around the edge of the spiracular plate, the plates being widely separated; by the broad bands of spines in front of and behind the inter-segmental conjunctivae; and by the markedly curved respiratory slits in the posterior spiracles.

Head with the usual very slightly convex antennal organ and the usual group of maxillary sensoria; segment I with a short inconspicuous dorsal band of minute spines of five or six rows in the interval between the anterior spiracles, no pleural or ventral spines; segment II with an anterior dorsal band of seven or eight rows of black spines in the mid-dorsum, tapering to two rows laterally, opposite the outer margins of the spiracular plates, then broadening to cover about one-third of the segment and with eleven to twelve rows in the mid-venter; a posterior band of much smaller spines, with only one or two rows on the mid-dorsum, broadening laterally to eight or nine rows but narrowing again in the ventral region; segments III–IX with broad anterior bands covering one-fourth to one-third of the segment and composed of seven to ten rows; and also with posterior bands, the band of seven or eight rows of minute spines on segment III, but the band broadening progressively, while its spines become larger toward the posterior extremity; segment X with the posterior band passing in front of the anal plate without interruption, but the anterior band of segment XI interrupted at the anus, broad ventrally and laterally, but composed of scattered inconspicuous rows dorsally; the posterior extremity with a cap of scattered but rather conspicuous spines ventrad of the spiracles, near which the spine rows become sparse, with small elements.

Respiratory system metapneustic, the anterior spiracles (Fig. 28) with thirteen to fifteen respiratory papillae, carried at the ends of elongated and sometimes bifurcated tubules, arising from the felt-chamber, the respiratory papillae on the margin of the colorless spiracular plate; posterior spiracles (Fig. 27) in the form of black, roughly semi-circular plates, separated by rather less than one-half their diameters, each with three respiratory slits, all very distinctly curved.

Buccopharyngeal armature (L., 0.86 mm.) short and stout, (Fig. 30) the anterior teeth curved downward, tapering to a rather acute tip, with a rounded erect dorsal process at the base, apparently fused with the intermediate region, the two regions together shorter than the posterior region, the posterior wings markedly divergent, the dorsal wing short and broad.

Stomatodexia diadema Wied.

This name appears to be generally accepted for this well-known parasite of *Diatraea,* though Townsend, in the Manual of Myiology (Vol. IV, p. 68) places it in the genus *Leskiopalpus.*

Stage I.—(Length, 1.04 mm.; width, 0.214 mm.)

In this stage the larva has broad bands of spines encircling the first three segments, an elongate narrow band at the junction of III and IV, followed by six oval ventral bands and a smaller seventh, with a ring of spines at the junction of X and XI and a few additional elements on XI; there is a marked constriction between X and XI, which is globular; there are some rod-like sensorial organs on XI.

Cuticle colorless, without pigmented plates; head with a semi-oval antennal organ and ventrad of this a straight club-shaped sensorium which probably belongs to the maxillary group; below the oral opening (but possibly situated on segment I) a broad ventral pad of seven or eight rows of small stout dark spines, directed backward; segment I in addition to the above post-oral pad, with an anterior band of about four rows of backwardly directed spines, the band narrowing in the pleural area but broadening a little ventrally; in addition, a short band of two or three rows across the dorsum; segment II with a very broad anterior band, covering about one-half the segment ventrally and laterally, but about two-thirds dorsally, where, however, it divides into two bands, connected in the pleural area but widely separated on the dorsum; segment III with a complete anterior band comprising about twelve rows ventrally but narrowing to about three rows dorsally; segment IV with a much narower band of eight or nine rows ventrally, diminishing to five or six rows in the pleural area, where the band is wider than in its ventral part; the anterior edge of the band includes some forwardly directed spines which presumably belong to the posterior edge of the preceding segment; several rows of such spines appear on the posterior edge of IV in the ventral region, blending with the anterior ventral spine band of V comprising four or five rows; behind this pad and extending to the middle of the pleural area, is a separate band of two or three rows; the ventro-posterior area of V bears, like IV, some rows of forwardly directed spines, behind which is the ventro-anterior spine pad of VI; behind this is a narrow separate band of small spines, and, again, some ventro-posterior forwardly directed spines blending with the ventro-anterior spine pad of VII; behind this, as on VI, is a separate band of two or three rows of weak spines; the next three ventral spine pads and the accessory bands are similar, but in the IX–X pad, the anterior elements are distinctly stronger than the posterior and this is evident also in the short X–XI ventral band; behind the ventro-anterior pad of X, the separate accessory band, of two or three rows of small nodule-like elements, almost encircles the segment; segment XI bears a dorsal pad of small forwardly directed acute spines and a ventral pad of small nodules, most of which bear short combs of forwardly directed spicules; this segment also bears some rod-like sensory organs of which I have detected a dorsal and a terminal pair.

Respiratory system metapneustic; posterior spiracles opening at the end of short but prominent hollow processes inserted a short distance before

the posterior extremity; each spiracle with a pair of respiratory slits, the felt-chambers elongate (Fig. 24) (L., 0.066 mm.) about eight times as long as wide.

Buccopharyngeal armature (L., 0.016 mm.) (Fig. 25) terminating as usual in a median unpaired tooth; anterior region straight, about three times as long as high, bent slightly downward from the intermediate region, which is about five times as long as the anterior region, when measured from the anterior edge of the ventral posterior wing; anterior region rounded dorsally and ventrally to form a moderately acute median tooth; a peculiar and characteristic feature of the organ is that the ventral half of the anterior region is pale, almost colorless while the dorsal half is deeply pigmented like the rest of the armature; ventral and dorsal wings of the posterior region well developed; base of the dorsal wing only slightly narrowed, the inner margins almost parallel; lateral anterior plates rather complex in form, each produced ventrally in a distinct tooth so that the homology with the paired mandibles in the later stages is clearly indicated; behind and below the sclerite of the salivary gland is an additional ribbon-like sclerite, with the ends directed backward and upward; this may support the duct of the salivary gland.

Stage II.—(Length, 5.7 mm.; width, 1.5 mm. (large specimen).)

Cuticle colorless; antennal organ small, only slightly convex; segment I with a dorsal patch of about four rows of small black spines, a similar patch below the oral opening, a line of scattered spines connecting the two patches; remainder of the body almost spineless, the only elements I can detect being short single rows of minute spines on the ventral surface in front of and behind the intersegmental conjunctivae; some minute nodules on segment XI.

Respiratory system metapneustic; posterior spiracles slightly protuberant, each with two respiratory slits; felt-chambers (L., 0.115 mm.) short and stout about three times as long as broad.

Buccopharyngeal armature (L., 0.115 mm.) (Fig. 40) well developed with a distinct articulation between the anterior and intermediate regions; anterior paired hooks rather sharply curved, tapering to a rather acute point; about 0.38 the length of the intermediate and posterior regions combined; above the dorsal edge of the anterior region, the base of each anterior tooth gives off a rather elongate process; interval between the upper and lower wings of the posterior region only about two-fifths the length of the posterior region; the existence of the dorsal process of the anterior region and the short notch between the wings of the posterior region, distinguish the mouth hook from that of *Paratheresia* which it resembles in its general form.

Stage III.—(Length, 9.0 mm.; width, 2.0 mm.)

This stage of *Stomatodexia diadema* is characterized by the presence of a flat colorless anterior spiracular plate, bearing from twenty to thirty brown spiracular papillae, by the contiguous black, semi-circular posterior spiracles, with their three short slits and by the presence on all the segments of exceptionally broad bands of spines.

Head with the usual minute flat antennal organ and the maxillary sensoria but without spines; segment I small, conical, with a band comprising about seven rows of small spines, encircling the anterior one-half to one-third; segment II with an anterior spine band, comprising about seven straight rows dorsally, narrowing as it passes behind the anterior spiracle, expanding to six or seven rows ventrally; segment III with an anterior band of six or seven rows and a somewhat narrower posterior band, comprising only a few scattered spines on the dorsal region; segments IV–X with broad bands circling the body at the conjunctivae; segment XI almost completely covered with rows of spines; a characteristic feature is that the spines are frequently arranged in ovals or polygons; as usual, the elements on the anterior borders are directed backward, the elements on the posterior borders are directed forward.

Respiratory system amphipneustic; anterior spiracle (Fig. 41) in the form of a large flat colorless spiracular plate, (Diameter 0.30 mm.) bearing twenty to thirty brown spiracular papillae, carried at the end of branching tubules arising from the felt-chambers; posterior spiracles (Fig. 38) in the form of flat semi-circular raised plates, (Diameter, 0.23 mm.) practically contiguous, each with three short straight slits, radiating from the spiracular button, the median slit directed laterally, the other two directed obliquely above and below it.

Buccopharyngeal armature (L., 0.71 mm.) (Fig. 32) elongate, the anterior paired hooks short, stout, extending almost straight forward, only slightly curved, with an acute tip and a distinct notch before the rounded ventral process; in this notch, several short stout spines; anterior hooks basally separated from the intermediate region, which narrows rapidly just behind the sclerite of the salivary gland and extends in the form of a long triangle into a triangular gap in the front of the posterior region, which thus sends out a narrow dorsal process and a broader ventral process above and below the intermediate region; wings of the posterior region diverging sharply, the dorsal wing broad, with an almost vertical anterior edge; posterior region from end to tip of the anterior ventral process, about one and one-half times as long as the anterior and intermediate regions together.

Paratheresia claripalpis v.d.Wulp.

The systematic status and host relations of the described species of *Paratheresia* were discussed by van Emden in 1949 in a paper to which C. W. Sabrosky contributed the results of his studies on United States National Museum material. From these studies it appears that there are only two species in the genus: *claripalpis* v.d.W. and *brasiliensis* T.T., and that the Trinidad species is *claripalpis*. *P. diatraeae* Brèthes is a synonym of *claripalpis* so the figures of the primary larva and pos-

terior stage III spiracles given by H. L. Parker in his "Miscellaneous Notes on South American Dipterous Parasites" (1953) should apply to the Trinidad species and in fact they do.

Stage I.—(Length, 1.00 mm.; width, 0.17 mm.)

Cuticle colorless but with a characteristic armature of cuticular plates having the form of short dark strips, usually broader than long and bearing rows of closely set short spines so that the plates are comb-like or pectinate; circular and rod-like sensoria are visible on all the segments.

Head with a relatively elongate antennal organ (Fig. 21) rounded at the end and set on a short cylindrical base; maxillary organ with a prominent clavate sensorium with a curved stem so that its end is bent over; this type of sensorium often exists in Dexiine larvae such as that of *Dexia rustica* F. It is present also in the larvae of *Billaea* and *Estheria*, which have "mouth hooks" similar to those of *Paratheresia* and pectinate plates, though the cuticular armature is far more complete. Segment I bearing on each side of the mid-ventral line, a large patch of oblique elongate narrow plates, set on their posterior edges with combs of spines; behind this a band of much shorter and larger plates, broadening ventrally where it disappears before meeting the corresponding band of the opposite side; also a similar dorsal band on each side, which does not meet either the corresponding band or the latero-ventral band; plates of these bands all pectinate, the spines of the posterior elements the longest; segment II bearing dorsally a pair of plate patches, extending about one-third the way to the posterior border and separated dorsally by a bare narrow interval; behind each of these patches, near the posterior border, a group of about twelve weak elements; each pleural area bearing two elongate plate patches, extending almost to the posterior border, the ventro-pleural patch being broader than the dorso-pleural; ventral region with a trident-shaped plate patch, of which the lateral arms are much narrower than the central arm; this patch extends about one-half way to the posterior border and behind it is a small scattered group of plates, interrupted in the mid-ventral region; segment III with an anterior band of five or six rows of pectinate plates; this consists of a ventral band, two pleural bands and a dorsal band; between this band and the posterior border is a row of a few scattered plates; the bands on III cover the anterior one-fourth of the segment; the thoracic segments can be identified by the small groups of sensory hairs marking the attachment of the histoblasts of the imaginal legs; segments V, VI, VII and VIII very similar but with a more distinct ventral band across the middle of the segments; on segment VIII there appears, near the posterior margin, a row of small plates, with their spines directed forward; segment X bearing dorsally a feeble row of pectinate plates, interrupted in the middle, and a broad ventral patch of four or five rows, occupying the anterior one-third of the segment; between this and the posterior border is an additional ventral row and on the posterior

border is a double row of plates with spines directed forward, encircling the segment; segment X is similar, but the posterior band shows a median indentation, behind which is the anal opening; segment XI shows an anterior band of about three rows of elements, interrupted dorsally and a small ventral patch between this and the posterior extremity; rod-like and circular sensoria appear on all the segments, the abdominal segments bearing ventrally a row of six circular sensoria, outside which, on each side, are a rod-like sensorium and two circular sensoria; the last segment bears ventrally four short sensorial hairs and four circular sensoria, dorsally, four sensorial hairs and two circular sensoria, while two long stout sensorial spines arise from the posterior end.

Respiratory system metapneustic; posterior spiracles (Fig. 39) situated a short distance in front of the posterior extremity on the dorsal surface; each spiracle opens in a short tubular process and has two respiratory slits; felt-chambers well developed, (L., 0.07 mm.) about nine times as long as wide.

Buccopharyngeal armature (L., 0.08 mm.) (Fig. 35) characterized by the broad anterior region of which the dorsal side is slightly convex, the ventral side markedly convex, the dorso-anterior angle pointed but obtuse; anterior region longer than intermediate region, the two together not much more than one-half the length of the posterior region, the stem of the dorsal wing not markedly narrowed, the intra-alar space about one-half the length of the posterior region; in front of the median tooth and apparently forming a kind of labrum, a transverse pigmented plate, laterally acute; below the median tooth on the pharyngeal wall, another pigmented plate; sclerite of the salivary gland well developed.

Stage II.—(Length, 3.4 mm.; width, 0.8 mm.)

In this stage the larva might be confused with the corresponding stage of *Stomatodexia diadema* from which it can be distinguished by the form of the buccopharyngeal armature and the presence of broad spine bands on segments IX, X and XI, the anterior region being practically spineless, except for short ventral patches on I and VIII.

Head spineless, with a small slightly convex antenna and the usual maxillary sensoria; segment I with a ventral group of three of four rows of rather broad small spines, backwardly directed; segment VIII with a posterior ventral band of three or four rows of forwardly directed small spines; segment IX with a broad posterior band of seven or eight rows of similar spines, also directed forward; segment X with a still broader posterior band of about nine rows, partly interrupted at the anal opening, which it encircles; segment XI with an anterior band of six or seven rows, broadening in the pleural area, but broadly interrupted ventrally, the posterior half of the segment encircled by a broad band comprising, in front, elements directed backward and behind, elements directed forward and many of which show the pectinate structure characteristic of stage I; some stout rod-like sensoria, terminating in a short slender filament are visible on this segment.

Respiratory system metapneustic, the posterior spiracles large, each with two respiratory slits, the felt-chambers (L., 0.06 mm.) about one and one-half times as long as wide.

Buccopharyngeal armature (L., 0.285 mm.) (Fig. 17, 36) with the paired anterior teeth closely appressed; anterior region strongly curved, the hooks acute at their tips, enlarged basally but without a distinct dorsal process, over twice as long as the intermediate region, measured to the ventral wing of the posterior region; anterior and intermediate regions together about three-fourths as long as the posterior region more or less distinctly fused (the two figures show individual variation); inner sides of the posterior wings slightly diverging, the intra-alar space about seven-tenths the length of the posterior region, being much deeper than in *Stomatodexia*.

Stage III.—(Length, 10.0 mm.; width, 2.0 mm.)

The most distinctive character of this stage is the pair of anterior spiracles which stand out on the larval cuticle at the junction of segments I and II as large black oval plates and protrude markedly from the anterior region of the puparium.

Head with the usual small flattened antennal organ and the normal maxillary sensoria; segments I–VII without spines; segment VIII with a ventral posterior band of three or four rows; IX with a broader anterior band of five or six rows of smaller spines and a prominent posterior band of six or seven rows of forwardly directed spines, encircling the segment; segment X with a similar anterior band of five to seven rows of backwardly directed spines; this band is interrupted on each side in the ventrolateral region and its ventral portion consists only of two irregularly spaced rows; the posterior margin of X bears a broad band of about five rows of spines directed forward and this encircles the segment, diminishing in width at it passes in front of the large anal plate, which is at the anterior margin of segment XI; segment XI bears a patch of spines on each side of the anal plate and a posterior band of three or four rows of spines grouped in gentle curves and encircling the tail; there is also a vague band of scattered spines across the middle of the ventral region.

Respiratory system amphipneustic; anterior spiracles (Fig. 33) in the form of oval dense black elevated plates (Diameter, 0.21 mm.) lying at the junction of segments I and II and each bearing some twenty-five respiratory papillae; posterior spiracles (Fig. 34) lying close together just above the posterior end, having the form of subcircular plates, (Diameter, 0.26 mm.) black in color, the "button" or moulting scar on the posterior edge near the mid-dorsal line, the spiracular slits long and only slightly curved, the inner slit directed forward and slightly outward, the outer slit directed laterally and slightly upward, the median slit half way between them.

Buccopharyngeal armature (L., 1.07 mm.) (Fig. 37) characterized by the separation of the intermediate region from both the anterior and the posterior regions; anterior tooth unusually stout, gently curved, acute at tip

with a short blunt dorsal process and a rounded ventral process at the base; intermediate region short, narrow in front but expanding posteriorly, the sclerite of the salivary gland distinct; posterior region with the upper wing relatively narrow, the wings diverging only slightly; posterior region (dorsal wing) about as long as the anterior and intermediate regions together.

Except for their general form and the pro-thoracic cornicles, which may be present or absent, the puparia simply show the characters of stage III. However, though a detailed description seems unnecessary, the following simple key may be useful.

1. Posterior extremity pointed, spiracles small but prominent, separated by a narrow line, slits short, raised, radiating from the button, with middle slit along transverse axis; anterior spiracles large, almost circular, separated by less than the diameter of one of them, with 25–30 papillae; prothoracic cornicles absent .. *Stomatodexia diadema*
   Posterior extremity rounded, prothoracic cornicles present 2
2. Anterior spiracles large, circular, separated by two times the diameter of one of them, with about 18 papillae along the outer edges; posterior spiracles with markedly curved slits .. *Metagonistylum minense*
   Anterior spiracles prominent but small 3
3. Anterior spiracles with six or seven papillae, posterior spiracles small with slits radiating above and below transverse axis *Lixophaga diatraeae*
   Anterior spiracles with about twenty-five papillae; posterior spiracles large, slits all radiating dorso-laterally ..... *Paratheresia claripalpis*

Biology

It is generally believed that the females of the four species treated in this paper deposit their larvae near the places where the host larvae are feeding and that the larvae then make their way to the hosts. *Palpozenillia,* which deposits microtype eggs, is said to deposit them in the frass left by the caterpillar. They must then be swallowed by the host and this mode of entry has been demonstrated in practice by feeding eggs to caterpillars.

After penetrating the cuticle of the caterpillar with their cutting mouth hook, *Stomatodexia* and *Paratheresia* leave their posterior extremity in the entrance hole. The hypodermis reacts by producing an integumental funnel (Fig. 42) in which the parasite larva remains until some time in the third stage, after which it kills the host caterpillar and emerges to pupate. *Lixophaga* and *Metagonistylum,* however, pass through the cuticle

into the body cavity and then attach themselves by the posterior extremity to one of the great tracheal trunks or to a main branch. A tracheal sheath (Figs. 7, 15) then forms around the larva. It is composed partly of a pigmented secretion from the hypodermis, and partly by unpigmented material. In both species, the first stage mouth hook can be found in the sheath after the larva has transformed to stage II, the attachment to the trachea presumably occurs in stage I shortly after the entrance into the host. It is interesting to note that while *Lixophaga* possesses a special apparatus adapted to the task of breaking open the host trachea and attaching the parasite larva to it, this does not exist in *Metagonistylum*. Like the other two species, *Lixophaga diatraeae* and *Metagonistylum minense* leave the skin of the host caterpillar to pupate.

The only other point of interest I have noted in my very limited series of dissections of *Diatraea* caterpillars in Trinidad is that when *Stomatodexia* and *Paratheresia* occur in the same caterpillar, the *Paratheresia* larvae are usually dead and surrounded by a phagocytic capsule, or they have an unhealthy appearance.

Acknowledgments

My grateful thanks are due to my wife, who prepared the drawings illustrating this paper from my camera lucida sketches. I must thank again Mr. F. D. Bennett and his assistants for supplying the material on which the studies were based.

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Explanation of Figures

Plate VI

Fig. 1. *Lixophaga diatraeae* T.T. Buccopharyngeal armature, Stage I.
Fig. 2. *Lixophaga diatraeae* T.T. Head of ♀ from side.
Fig. 3. *Lixophaga diatraeae* T.T. Antennal organ, Stage I.
Fig. 4. *Lixophaga diatraeae* T.T. Tip of median hook, enlarged.
Fig. 5. *Lixophaga diatraeae* T.T. "Felt-chamber" and posterior spiracle, Stage II.
Fig. 6. *Lixophaga diatraeae* T.T. "Felt-chamber", posterior spiracle and posterior hook, Stage I.
Fig. 7 *Lixophaga diatraeae* T.T. Lower part of tracheal sheath, showing attachment.

Plate VII

Fig. 8. *Metagonistylum minense* T.T. Buccopharyngeal armature, Stage I.
Fig. 9. *Metagonistylum minense* T.T. Head of ♀ from side.
Fig. 10. *Lixophaga diatraeae* T.T. Pupal spiracle and cornicle.
Fig. 11. *Metagonistylum minense* T.T. Tip of median hook, enlarged.
Fig. 12. *Lixophaga diatraeae* T.T. Buccopharyngeal armature, Stage III.

Plate VIII

Fig. 13. *Lixophaga diatraeae* T.T. Buccopharyngeal armature, Stage II.
Fig. 14. *Metagonistylum minense* T.T. Anterior spiracle, Stage II.
Fig. 15. *Metagonistylum minense* T.T. Stage II larva in tracheal sheath.
Fig. 16. *Lixophaga diatraeae* T.T. Anterior spiracle, Stage III.
Fig. 17. *Paratheresia claripalpis* v.d.W. Buccopharyngeal armature, Stage II.
Fig. 18. *Metagonistylum minense* T.T. "Felt-chamber" and posterior spiracle, lateral and end views, Stage II.
Fig. 19. *Metagonistylum minense* T.T. "Felt-chamber" and posterior spiracle, Stage I.
Fig. 20. *Stomatodexia diadema* Wied. Antennal organ, Stage I.
Fig. 21. *Paratheresia claripalpis* v.d.W. Antennal organ, Stage I.
Fig. 22. *Lixophaga diatraeae* T.T. Posterior spiracles, Stage III.
Fig. 23. *Metagonistylum minense* T.T. Antennal organ, Stage I.
Fig. 24. *Stomatodexia diadema* Wied. Posterior extremity, "felt-chambers" and spiracles, Stage I.

Plate IX

Fig. 25. *Stomatodexia diadema* Wied. Buccopharyngeal armature, Stage I.
Fig. 26. *Stomatodexia diadema* Wied. Head of ♀ side view.
Fig. 27. *Metagonistylum minense* T.T. Posterior spiracles, Stage III.
Fig. 28. *Metagonistylum minense* T.T. Anterior spiracle, Stage III.
Fig. 29. *Metagonistylum minense* T.T. Buccopharyngeal armature, Stage II.

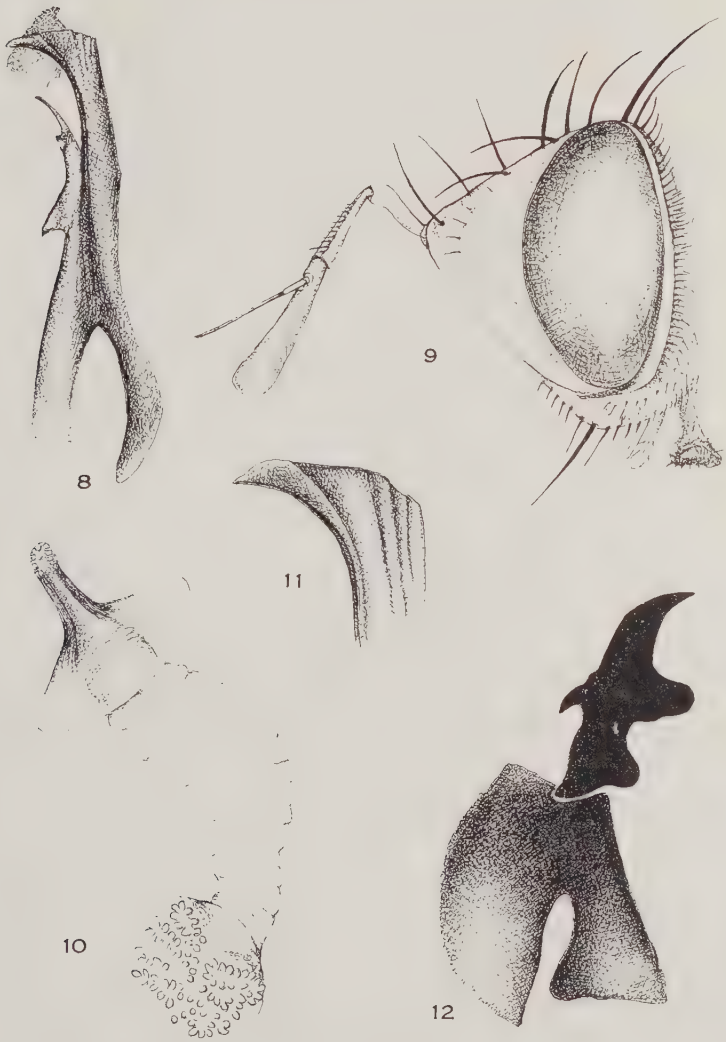
PLATE X

Fig. 30. *Metagonistylum minense* T.T. Buccopharyngeal armature, Stage III.
Fig. 31. *Paratheresia claripalpis* v.d.W. Head of ♀ side view.
Fig. 32. *Stomatodexia diadema* Wied. Buccopharyngeal armature, Stage III.
Fig. 33. *Paratheresia claripalpis* v.d.W. Anterior spiracle, Stage III.
Fig. 34. *Paratheresia claripalpis* v.d.W. Posterior spiracles, Stage III.

PLATE XI

Fig. 35. *Paratheresia claripalpis* v.d.W. Buccopharyngeal armature, Stage I.
Fig. 36. *Paratheresia claripalpis* v.d.W. Buccopharyngeal armature, Stage II.
Fig. 37. *Paratheresia claripalpis* v.d.W. Buccopharyngeal armature, Stage III.
Fig. 38. *Stomatodexia diadema* Wied. Posterior spiracles, Stage III.
Fig. 39. *Paratheresia claripalpis* v.d.W. Posterior extremity, showing "felt-chambers", posterior spiracles and terminal setae, Stage I.
Fig. 40. *Stomatodexia diadema* Wied. Buccopharyngeal armature, Stage II.
Fig. 41. *Stomatodexia diadema* Wied. Anterior spiracle, Stage III.
Fig. 42. *Stomatodexia diadema* Wied. Integumental sheath containing larva at Stage III.

THOMPSON: TACHINID LARVAE



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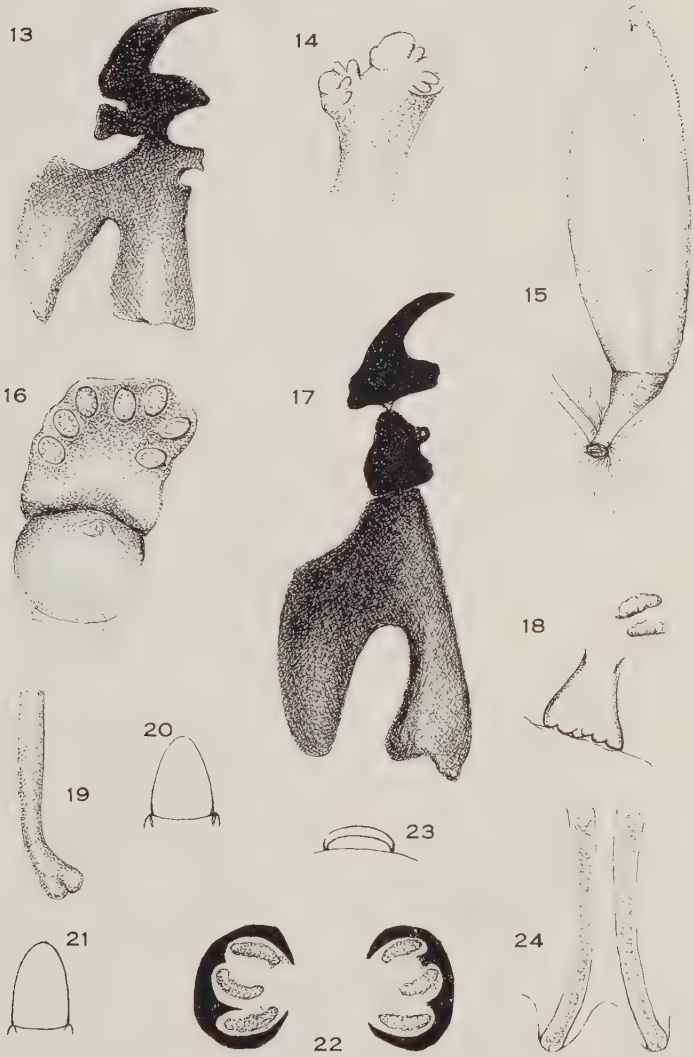

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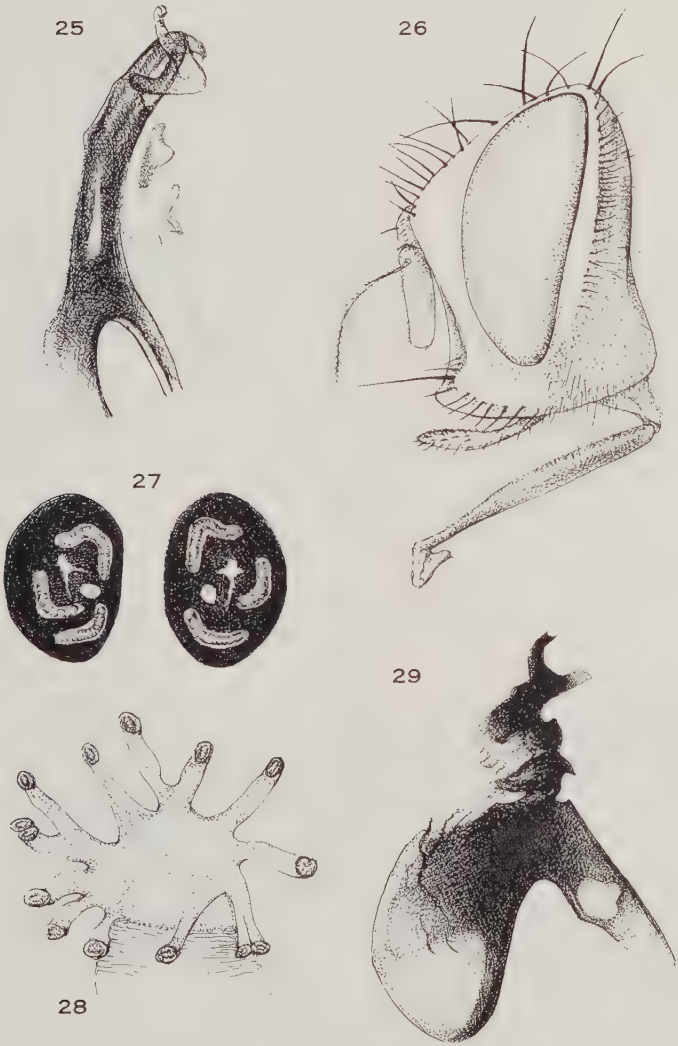

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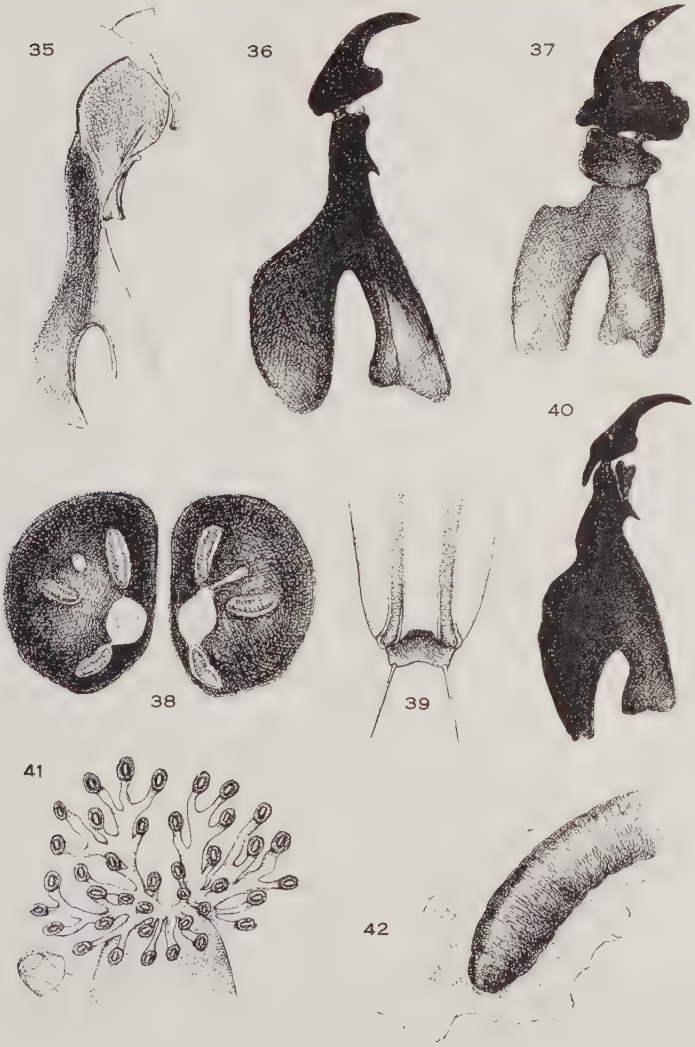

THOMPSON: TACHINID LARVAE

A REVISION OF THE GENUS BRACHYMERIA WESTWOOD IN AMERICA NORTH OF MEXICO (HYMENOPTERA: CHALCIDIDAE)

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The genus *Brachymeria* includes the most common and widely distributed species in the family Chalcididae. They are parasites, often reared from a wide variety of Lepidoptera of economic importance. The hosts of the species occurring in America north of Mexico include the cotton leafworm (*Alabama argillacea* (Hbn.)), white-marked tussock moth (*Hemerocampa leucostigma* (J. E. Sm.)), gypsy moth (*Porthetria dispar* (L.)), velvet bean caterpillar (*Anticarsia gemmatilis* Hbn.), oriental fruit moth (*Grapholitha molesta* (Busck)), corn earworm (*Heliothis zea* (Bod.)), range caterpillar (*Hemileuca oliviae* Ckll.), western oak looper (*Lambdina fiscellaria somniaria* (Hulst.)), puss caterpillar (*Megalopyge opercularis* (J. E. Sm.)), bagworm (*Thyridopteryx ephemeraeformis* (Haw.)), strawberry leafroller (*Ancylis comptana fragariae* (W. & R.)), codling moth (*Carpocapsa pomonella* (L.)), red-banded leafroller (*Argyrotaenia velutinana* (Walk.)), and apple leaf skeletonizer (*Psorosina hammondi* (Riley)), as well as an extremely large number of other Lepidoptera.

Unfortunately all the species of *Brachymeria* look very much alike, but they differ widely in habits. Five species are primary parasites of Lepidoptera, but two species are secondary parasites, attacking their tachinid primary parasites. Two others may be either primary or secondary parasites of lepidopterous hosts. Another species parasitizes blow flies, and two others are secondary parasites of grasshoppers, parasitizing their tachinid or sarcophagid primary parasites. It is thus obvious that precise segregation of species is highly important in any host-parasite studies involving this genus. For instance, in the project to introduce *intermedia* (Nees) from Europe for biological control of the gypsy moth in New England, it was necessary carefully to

exclude *compsilurae* (Crawford), a native secondary parasite of this and other moths.

The genus *Brachymeria* has not been revised for North America since 1910, and since then a large amount of material has accumulated, much of which represents undescribed species. In the present paper 27 valid species are treated, 8 of which are new. The genus *Brachymeria* itself is redefined, and 2 new subgenera are proposed.

Acknowledgments

I am indebted to J. A. G. Rehn and Harold J. Grant, Jr., of the Academy of Natural Sciences of Philadelphia, for making the Cresson types available for study and for lending a large collection of undetermined *Brachymeria* specimens. O. Peck, of the Canada Department of Agriculture, Ottawa, also loaned a very large collection of specimens. Other material used in preparing this revision is in the U. S. National Museum. The late J. C. Crawford and A. B. Gahan, both of whom formerly worked with the U. S. National Museum collection, left manuscript notes on this genus. These notes provided a starting point for my own studies.

I acknowledge with sincere thanks the assistance rendered by H. E. Milliron and G. J. Kerrich, who together studied and made detailed notes on several Walker types in the British Museum (Natural History). J. R. Steffan, Museum National d'Histoire Naturelle, Paris, kindly donated material of the subgenus *Neobrachymeria* Masi. K. W. Cooper gave his opinion about the problem of color variation in the females of *coloradensis* (Cresson).

Specific Characters

In the descriptions that follow, when the length and width of the clypeus are used, the length is measured at the meson and the width is the greatest straight-line distance between the two lateral margins. The length of the labrum is measured at the meson and the width at the dorsal margin. The widths of the parascrobal space and the scrobe cavity are measured at the level of the apex of the antennal radicle. Since the lateral ocel-

lus is oval, rather than round, its diameter is measured across its greatest extent. The ocellocular line is the shortest distance between the margins of the lateral ocellus and the compound eye. Although all measurements were made with an ocular micrometer, the measurements given in the descriptions are expressed in terms general enough to cover the actual or probable variation among specimens of a species. Size difference of less than ten percent is indicated as "slightly."

There are good specific characters in the mandibular teeth in *Brachymeria*, but these are difficult to see unless the head of the specimen is removed and cleared in KOH. Specimens are so stoutly constructed that the mandibles cannot successfully be dissected or spread in uncleared specimens, even though they are relaxed. In long series of specimens of a species it usually is possible to find specimens that show the teeth of one mandible or the other (specimens never seem to perish with the mandibles spread). Most specimens close their mouths with the teeth of the left mandible covering the teeth of the right mandible, but in a few specimens this is reversed. In some specimens the mandibular teeth are badly worn, so that these characters are lost.

The surface of the thoracic dorsum of all specimens is densely covered by umbilicate punctures. The character of the surface of the interstitial spaces between these punctures varies in different species or in different parts of the thorax of a single species. In some the interstices are sculptured and dull, but in others they are smooth and shining. There is a similar difference among species in the character of the outer surface of the hind femora. In all species the hind femur is more or less hairy, but the surface between the hair bases may be smooth and shining, lightly sculptured and subshining, or deeply sculptured and dull.

There are differences among species in the male genitalia, but these are not very marked. I used these in a previous paper,[1] but have abandoned them in this paper. Unfortunately it is not possible to extract the male genitalia without destroying the gaster. As the gaster has several good sets of external characters, it does not seem wise to sacrifice them in order to see the mediocre genital characters.

[1] Trans. Ill. Acad. Sci. 29: 252, 1936.

Genus **BRACHYMERIA** Westwood

Description.—Frons relatively flat, not rounded anteriorly as in *Trigonura;* antennal insertion at or dorsal to level of ventral margins of compound eyes; surface within scrobe cavity smooth or very faintly reticulated; occiput without vertical carinae. Thoracic notum with umbilicate punctation; fore coxa with anterior surface flattened and carinate laterally, forming a groove into which the base of the mandible and the apex of the gena fit in repose; anterior median margin of mesosternum produced ventrally to form a flat shelf against which the fore coxae lie in repose; fore wing with postmarginal vein approximately half as long as marginal vein and usually twice as long as stigmal, postmarginal always longer than stigmal; prepectus narrow, elongate, much smaller than tegula, sometimes hardly visible; mid tibia with one apical spur, this spur bearing minute setae; scutellum with a narrow apical plate, this usually emarginate on meson, but scutellum lacking markedly long and prominent apical processes; hind coxa of female sometimes with an inner tooth; outer basal tooth of hind femur usually larger than any following teeth, sometimes the basal tooth much larger than others, teeth following the basal one numerous and small, never long and curved; an inner femoral tooth often present; hind tibia arcuate, with apex short-acuminate and bearing one weak spur, this spur usually slightly curved and seta-like at tip; apex of hind tibia, in repose, lying in a groove at apex of hind trochanter. Propodeum precipitous, alveolate, spiracles arcuate, narrow, lateral teeth absent on propodeum; gaster sessile; gaster with 7 terga, tergum 1 always the longest, usually making up a third to a half the dorsal length of gaster; tergum 6 bearing a pair of circular spiracles; tergum 7 with a pair of round, biscuit-like cerci near the anterior margin, each cercus bearing 5 bristles; ovipositor not or only slightly exserted, sheaths compressed; male apical gastral sternum slightly inflated, apical margin curved.

Key to Subgenera

1. Clypeus fused with face, frontoclypeal suture wanting.
   Matsumurameria Habu (Japan)
   Frontoclypeal suture present (Plate XII, fig. 2) 2
2. Gaster short, compact, truncate or subtruncate at apex, occasionally subacuminate; posterior margins of gastral terga 2 to 4 straight or almost so; antennae inserted above level of ventral margins of compound eyes ..... *Brachymeria* Westwood
   Gaster elongate, usually strongly acuminate at apex, occasionally subacuminate; posterior margin of gastral tergum 2 broadly and deeply emarginate on meson, sometimes terga 3 or 4 also emarginate on meson; antennae inserted at level of ventral margins of compound eyes 3
3. Scutellum with an elevation in the middle (Plate XIII, fig. 18)
   Gahanula new subgenus

Scutellum lacking a median elevation 4

4. Vertex with a transverse carina extending across just posterior to anterior ocellus, this carina continued downward on either side of frons (Plate XII, figs. 3, 7) ..... *Pseudobrachymeria* new subgenus

Vertex lacking a transverse carina

Neobrachymeria Masi (Asia Minor, Africa)

Subgenus **BRACHYMERIA** Westwood

Chalcis of authors, not the type species, Cresson, 1872, Trans. Amer. Ent. Soc., 4: 59; Cameron, 1884, Biol. Cent.-Amer., Ins., Hym., v. 1, p. 99; Howard, 1885, Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 5, 36; Howard, 1886, Ent. Amer., 1: 215; Cresson, 1887, Trans. Amer. Ent. Soc., Suppl. vol., p. 67, 234; Dalla Torre, 1898, Cat. Hym., v. 5, p. 385; Ashmead, 1904, Mem. Carnegie Mus., 1: 249, 250, 369; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 19, 20, 25; Crawford, 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 13; Viereck, 1916, Bull. 22, Conn. Geol. and Nat. Hist. Sur., p. 526.

Brachymeria Westwood, *in* Stephens 1829, Nomencl. Brit. Ins., p. 36; Stephens, 1829, Syst. Cat. Brit. Ins., pt. 1, p. 393; Westwood, 1832, Phil. Mag., ser. 3, 1: 127; Westwood, 1839, Synopsis Gen. Brit. Ins., p. 66; Gahan and Fagan, 1923, Bul. 124, U. S. Natl. Mus., p. 24; Waterston, 1923, Bul. Ent. Res., 14: 103; Gahan, Crosby, and Leonard, *in* Leonard 1928, Mem. 101, Cornell Univ. Agr. Expt. Sta., p. 976; Dowden, 1935, Jour. Agr. Res., 50: 495; Burks, 1936, Trans. Ill. Acad. Sci., 29: 251; Brimley, 1938, Ins. N. Car., p. 421; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 586; Burks, *in* Krombein *et al.* 1958, Monog. 2, Supp., U. S. Dept. Agr., p. 83.

The above literature citations apply to *Brachymeria* only in North America. Other papers giving regional revisions cover the literature for other parts of the world. See Ruschka,[2] Masi,[3] and Bouček[4] for the Palearctic region, Steffan[5] for France, Nikolskaja[6] for Russia, Erdös[7] for Hungary, Masi[8] and Schmitz[9] for the Ethiopian region, Girault[10] for Australia, and Habu[11] for Japan.

[2] Konowia, 1: 221, 1922.
[3] Eos, Extr. Vol., p. 27, 1950.
[4] Acta Ent. Mus. Nat. Prag., 27 (Supp.): 17, 1952.
[5] Cahiers des Nat., n. s., 15: 35, 1959.
[6] Akad. Nauk U.S.S.R., Fauna U.S.S.R. 44, p. 86, 1952.
[7] Fauna of Hungary, v. 12, no. 2 (Hym. II), p. 11, 1955.
[8] Mem. Soc. Ent. Ital., 8: 114, 1929.
[9] Expl. Parc Nat. Albert, Mis. DeWitte, fasc. 48, p. 17, 1946.
[10] Mem. Queensland Mus., 4: 314, 1915.
[11] Bul. Nat. Inst. Agr. Sci. (Japan), ser. C, 11: 142, 1960.

Description.—Antennae inserted above level of ventral margins of compound eyes; apex of antennal scape not quite reaching level of anterior ocellus; scrobe cavity relatively narrow, parascrobal space wide, lateral scrobe margins usually not completely carinate; both left and right mandibles with 2 teeth or left with 2 and right with 3; vertex without a transverse carina; frontal carinae present or absent. Prepectus strap-like or peg-like in shape, in some species this structure hardly visible; wings sometimes shaded with brown; hind coxa of female often with an inner tooth; outer basal tooth of hind femur always as large as or larger than any following teeth, in a few species the basal tooth much larger than others; inner femoral tooth often present. Gaster compact or subacuminate, never elongate-acuminate; posterior margin of gastral tergum 2 straight or nearly so, never deeply emarginate on meson; tergum 7 small to minute, usually shorter than tergum 6.

Type species.—*Chalcis minuta* Fabricius (designated by Westwood, 1839).

Key to Species

1. Malar ridge branched or deflected backwards below compound eye, extending to join, or almost to join, posterior margin of cheek (Plate XIII, figs. 8, 9, 12) 2
   Malar ridge not branched or deflected backwards below compound eye (Plate XIII, fig. 13); if a short postorbital carina is present, it extends from margin of cheek toward malar ridge, but does not reach it (Plate XIII, fig. 16) 15
2. First gastral tergum completely and densely shagreened dorsally; apex of scutellum bidentate and face never with a pair of vertical rugae below antennal sockets 3
   First gastral tergum not completely and densely shagreened dorsally; if obscurely so, apex of scutellum is entire and face has a pair of short, vertical rugae below antennal sockets (Plate XII, fig. 2) ... 5
3. Face of female clothed laterally with dense, woolly, white hair; in both sexes, frontal carinae absent and labrum yellow; hind femur of female almost entirely yellow, male hind femur black with an apical yellow spot and, usually, also with a dorsal yellow spot near base *tegularis* (Cresson)
   Face not densely clothed with woolly hair; frontal carinae present, although often faint; labrum black; hind femur in both sexes black with apex yellow 4
4. Apex of scutellum with broad, flat teeth (Plate XIII, fig. 14); outer surface of hind femur dull, surface between hair punctures sculptured; apex of gaster truncate ..... *truncata* new species
   Apex of scutellum with narrower, slightly upturned teeth (Plate XIII, fig. 10); outer surface of hind femur shining, surface between hair punctures smooth and polished; apex of gaster not truncate *weemsi* new species

5. Mesonotum red; an oblique carina on either side of face extending from malar ridge to scrobe cavity ..... *belfragei* (Crawford)
   Mesonotum black; oblique carinae absent on face 6
6. Hind femur relatively narrow (Plate XIV, fig. 20), outer surface shining and sparsely pubescent, color red with apex yellow in both sexes; a well developed, sharp inner tooth present at base of hind femur (Plate XIII, fig. 11); frontal carinae present (Plate XIII, fig. 12). *fonscolombei* (Dufour)
   Hind femur more plump (Plate XIV, fig. 23), usually black with apex yellow in both sexes, red with apex yellow in female of one species .. 7
7. Occiput, thoracic notum, and second and following gastral terga densely clothed with coarse, golden pubescence; occipital carinae extending almost to dorsal meson of head (Plate XII, fig. 4). *mexicana* (Dalla Torre)
   Gastral terga not densely clothed with coarse, golden pubescence; occipital carinae shorter (Plate XII, figs. 5, 6) 8
8. Interstices between umbilicate punctures in median basal area of scutellum reticulated, dull; occipital carinae extending far dorsally (Plate XII, fig. 5) 9
   Interstices in median basal area of scutellum smooth, shining; occipital carinae not extending so far dorsally (Plate XII, fig. 6) 12
9. Lateral ocellus set in a shallow pit (Plate XII, fig. 5); frontal carinae wanting; scutellum deeply emarginate at apex .. *russelli* new species
   Lateral ocellus not set in a pit; frontal carinae present, although sometimes poorly developed 10
10. Scutellum strongly arched and with a broad, medianly emarginate plate at apex; surface of lateral frenum of scutellum forming a 45° angle with transverse axis of body; apex of gaster truncate; right mandible with 2 teeth ..... *aeca* new species
    Scutellum more nearly flat and with apical plate entire; surface of lateral frenum of scutellum forming nearly a 90° angle with transverse axis of body; apex of gaster acuminate; right mandible with 3 teeth 11
11. Face with a pair of vertical rugae below scrobe cavity (Plate XII, fig. 2); first gastral tergum usually punctate dorsally *hammari* (Crawford)
    Face without vertical rugae below scrobe cavity; first gastral tergum always smooth dorsally ..... *molestae* new species
12. Complete frontal carinae present in both sexes (Plate XIII, fig. 8) .. 13
    Frontal carinae absent, or vaguely indicated and short in males (Plate XIII, figs. 9, 17) 14
13. Apical half of scutellum with a vaguely defined, median, longitudinal depression; space between lateral ocellus and compound eye shagreened ..... *compsilurae* (Crawford)
    Apical half of scutellum without a depression; space between lateral ocellus and eye margin with umbilicate punctation *carinatifrons* Gahan

14. Hind femur black with apex yellow in both sexes, outer surface of femur smooth, shining; second gastral tergum with a usually medianly interrupted row of pits extending across dorsal area, posteriorly this tergum sculptured; hind coxa of female with a median tooth ..... *intermedia* (Nees)

    Hind femur reddish-tan with apex yellow in female,[12] black with apex yellow in male, outer surface subshining, sculptured; anterior row of punctures on second gastral tergum absent in broad median area, posteriorly this tergum smooth or almost so; hind coxa of female lacking median tooth ..... *coloradensis* (Cresson)

15. Basal tooth of hind femur large (Plate XIV, fig. 21) 16

    Basal tooth of hind femur small (Plate XIV, fig. 22) 18

16. Hind femur in both sexes red with an apical yellow spot or red and black with apex yellow; hind coxa of female with a median tooth *slossonae* (Crawford)

    Hind femur black and yellow in both sexes 17

17. Hind tibia with a median black band, hind femur black with apex yellow; head and body clothed with silvery pubescence; hind coxa of female with a median tooth ..... *incerta* (Cresson)

    Hind tibia entirely yellow, hind femur usually black centrally with base and apex yellow, sometimes mostly black with only apex yellow, or mostly yellow with black reduced to a small median spot; head and body with golden pubescence; hind coxa of female with an indistinct median tooth or with none ..... *robusta* (Cresson)

18. Face clothed with silvery pubescence, frontovertex and thoracic dorsum with golden pubescence in both sexes; apex of scutellum emarginate on meson; lateral face of pronotum with its dorsal carina extending to anterior pronotal margin (Plate XIII, fig. 15) *comitator* (Walker)

    Head and thoracic notum clothed with silvery pubescence in female, pubescence of these areas golden in male; apex of scutellum entire; lateral face of pronotum with its dorsal carina deflected downward before reaching anterior pronotal margin (Plate XIII, fig. 19) *ovata* (Say)

Brachymeria (Brachymeria) tegularis (Cresson)

Chalcis tegularis Cresson,*[13] 1872, Trans. Amer. Ent. Soc. 4: 60; Cresson, 1887, Trans. Amer. Ent. Soc., Supp. vol., p. 234; Dalla Torre, 1898, Cat. Hym., v. 5, p. 393; Viereck, 1906, Trans. Amer. Ent. Soc. 32: 244; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 28.

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[12] In approximately three percent of the female specimens the red area of the hind femur is overlaid by black. In the opinion of K. W. Cooper this seems to represent an intraspecific variation in which the female tends to assume the character of the male. The male hind femur does not vary appreciably in color.

[13] In the species bibliographies, when more than 4 references are included, the most important ones are indicated by an asterisk.

Brachymeria tegularis (Cresson) Burks,* 1936, Trans. Ill. Acad. Sci., 29: 251; Burks, 1940, Trans. Ill. Acad. Sci., 33: 208; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 588; St. Amand and Cloyd, 1954, Jour. Parasitol., 40: 83; Smith, 1957, Canad. Jour. Zool., 36: 259.

Female.—Length 4.0–5.0 mm. Black, with the following parts yellow: Labrum, anterolateral area at base of antennal scape, tegulae, forelegs except coxae, midlegs except bases of coxae, and hindlegs except dorsal and lateral areas of coxae, variable area at outer ventral margin of femur, apex of inner side of femur, and variable area at base and along dorsal margin of tibia; apices of antennae and mandibles, and seventh gastral tergum dark red-brown. A dense patch of woolly, white pubescence on either side of face, this vestiture extending over genae and onto cheeks; elsewhere on head and body pubescence not flattened, moderately dense, silvery.

Antennae inserted well above level of ventral margins of eyes; scrobe cavity not reaching anterior ocellus, lateral margins of scrobe carinate in ventral half, carina at ventral margin extending straight across base of interantennal projection; scrobe cavity 2⅓ times as wide as parascrobal space; antennal scape short and stout, its length 2½ times as great as its maximum width; pedicel and all funicle segments broader than long, club as long as apical 2 funicle segments; width of clypeus 4 times as great as its length; length of labrum ⅝ as great as its width; each mandible with 2 teeth; frontal carinae absent; malar ridge extending below compound eye to join lateral margin of cheek; ocellocular line ⅘ as long as diameter of lateral ocellus.

Median ⅗ of anterior margin of pronotum ecarinate; lateral face of pronotum with minute and irregular, closely set, longitudinal or oblique striae, sometimes 1 or 2 longitudinal rugae present near ventral margin; in most specimens interstices between umbilicate punctures of pronotum and anterior half of praescutum shagreened, posteriorly on praescutum and on scutellum interstices smooth, in some specimens posterior interstices faintly sculptured, with more anterior ones more strongly so; fore wing with stigmal vein ⅖ as long as postmarginal vein; scutellum convex in lateral aspect, apical flange broad, bidentate; lateral sector of scutellar frenum almost vertical, surface shagreened; hind coxa without median tooth; hind femur with outer surface densely setose, obscurely sculptured, subshining, basal tooth on ventral margin slightly broader than and as long as longest following teeth, 10 to 14 teeth present, these closely spaced near apex, slightly more widely spaced near base; inner femoral tooth absent.

Dorsal surface of first gastral tergum completely shagreened; second tergum with numerous hair punctures extending in an irregular band across anterior median area, posteriorly this tergum shagreened; sixth tergum bearing dense, deep, setiferous punctures, both interstices and surface within punctures shagreened; gaster subacuminate at apex, with dorsal surface of sixth tergum forming a 60° angle with longitudinal axis of body.

Male.—Length 2.5–4.0 mm. Color differing considerably from female; black, with the following parts yellow: Labrum, antero-lateral area at base of scape, tegulae, bases and apices of fore and mid femora and tibiae, fore and mid tarsi, apical spot and, usually, small streaks near base dorsally and ventrally on hind femora, and ventral side distad at base and at apex of hind tibiae; apices of mandibles, antennal club and ventral side of apical funicle segments, and hind tarsi, brown. Face lacking lateral patches of woolly pubescence, all pubescence of head and body fine, silvery. Gaster truncate at apex, cerci set in shallow depressions.

Type locality.—Texas.

Type.—Academy of Natural Sciences of Philadelphia, 1825, ♀.

Distribution.—Illinois and Tennessee west to Washington, Oregon, and California

Host relationships.—This is a hyperparasite of grasshoppers, having been reared from puparia of the tachinids *Ceracia dentata* (Coq.) and *Hemithrixion oestriforme* B. B. Both of these flies are primary parasites of Acrididae.

Brachymeria (Brachymeria) truncata new species (Plate XIII, fig. 14)

This species agrees with *tegularis* Cresson in having the malar ridge deflected backward beneath the compound eye, the first gastral tergum completely shagreened dorsally, the apex of the scutellum bidentate, the lateral sector of the scutellar flange shagreened, and the hind coxa of the female edentate. *B. truncata* differs from *tegularis* in possessing frontal carinae, in having the scutellar interstices strongly sculptured, in having the female hind femur mostly black instead of mostly yellow, and in having the gaster truncate at its apex.

Female.—Length 3.0–4.5 mm. Black, with tegulae, bases and apices of fore and mid femora and tibiae, apex of hind femur, spot near base and apex of hind tibia, and all tarsi, yellow; antennal scape may have a yellow area near base; apices of mandibles and antennal club red-brown. Pubescence of head and body fine, silvery.

Antennae inserted slightly below center of frons, above level of ventral margins of compound eyes; scrobe cavity extending almost to anterior ocellus, its dorsal margin a short, transverse carina located just ventral to ocellus, lateral scrobe margins carinate in ventral two-thirds, ventral margin deflected dorsad at base of interantennal projection; scrobe cavity twice as wide as parascrobal space; scape not quite extending to dorsal margin of scrobe cavity, length of scape 3 times as great as its maximum width; pedicel and all funicle segments broader than long, first funicle slightly longer than second; club as long as apical 2 funicles; width of clypeus 4 times its length, length of labrum ⅗ as great as its width; each

mandible with 2 teeth, ventral one extremely large; frontal carinae present, vague in some specimens; malar ridge deflected backward beneath compound eye and extending to margin of cheek; ocellocular line as long as diameter of lateral ocellus.

Median third of anterior margin of pronotum ecarinate; lateral face of pronotum with minute, irregular, closely set, oblique striae, several short, stout rugae extending backward from anterior margin and overlying the striae; all interstices between umbilicate punctures of thoracic dorsum shagreened; fore wing with postmarginal vein twice as long as stigmal; scutellum convex in lateral aspect, apical flange broad, bidentate; lateral sector of scutellar frenum shagreened, its surface almost vertical; hind coxa without a median tooth; outer surface of hind femur densely setose and minutely sculptured, mat; outer basal femoral tooth broader but no longer than following teeth, the latter closely set, 10 to 12 in number, inner femoral tooth wanting or faint.

Gaster as in *tegularis* except that apex is truncate, with dorsal surface of sixth tergum forming an 80–90° angle with longitudinal axis of body.

Male.—Length 3.0–4.0 mm. Color and pubescence identical to female; sixth gastral tergum projecting slightly farther posteriorly than does seventh tergum, dorsal surface of sixth tergum forming approximately a 100° angle with longitudinal axis of body.

Type.—Female. Waco, Texas, Aug. 3, 1948, collected on grass, P. A. Glick [U.S.N.M. no. 65101].

Allotype.—Male. Nueces River, Zavalo Co., Texas, Apr. 29, Hunter and Pratt [USNM].

Paratypes.—ARIZONA: 1 ♀, Canelo, Aug. 3, 1956, G. D. Butler. CALIFORNIA: 1 ♂, Daggett, Apr. 13, 1955, J. E. H. Martin [CDA]; 1 ♂, Helendale, May 21, 1955, W. R. M. Mason [CDA] COLORADO: 1 ♀, Ft. Collins, May 19, 1894, sweeping alfalfa, C. F. Baker. NEBRASKA: 1 ♀, Oxbow, Aug. 17, on buffalo bur (*Androcera rostrata*), T. D. A. Cockerell. NEW MEXICO: 3 ♀, 1 ♂, Las Cruces, on *Populus*, T. D. A. Cockerell; 1 ♀, Mesilla, June 16, T. D. A. Cockerell. SASKATCHEWAN: 1 ♀, Saskatchewan Landing, July 25, 1956, O. Peck [CDA]. TEXAS: 1 ♀, 1 ♂ [ANSP]; 1 ♂, Belfrage; 1 ♀, Brownsville, July, Wickham.

One ♂, 1 ♀ paratypes are deposited in the Academy of Natural Sciences of Philadelphia; 2 ♂ and 1 ♀ paratypes are deposited in the Canadian Department of Agriculture collection, Ottawa; the other paratypes are in the U. S. National Museum.

One ♀ and 1 ♂ specimens in poor condition, not included in the type series, are from Lincoln, Nebraska, Sept. 3, 1928, D. B. Whelan.

Host relationships.—Unknown.

Brachymeria (Brachymeria) weemsi new species (Plate XIII, fig. 10)

B. weemsi agrees with *tegularis* Cresson and *truncata* new species, in having the dorsal surface of the first gastral tergum shagreened, in having the apex of the scutellum bidentate, and in lacking the median coxal tooth in the female; *weemsi* agrees with *truncata* in possessing frontal carinae. It differs from both in having the anterior band of hair punctures of the second gastral tergum interrupted on the meson and in having the scutellar teeth relatively narrow and upturned.

Female.—Length 5.0 mm. Black, with ventral half of lateral face of antennal scape, tegulae, bases and apices of fore and mid femora and tibiae, apex of hind femur, spot near base and apex of hind tibia, and all tarsi, yellow; antennal club and hind trochanters red-brown. All pubescence fine and silvery.

Antennae inserted below center of frons, but well above level of ventral margins of compound eyes; scrobe cavity extending to anterior ocellus, entire lateral and dorsal scrobe margins carinate, ventral margin deflected dorsally on meson; parascrobal space ⅓ as wide as scrobe cavity; scape not reaching dorsal margin of scrobe cavity, length of scape 3 times as great as its maximum width; pedicel and all funicle segments broader than long, first funicle segment slightly longer than second, club as long as apical 2 funicles; labrum twice as broad as long; each mandible with 2 teeth; frontal carinae present, well marked; malar ridge deflected backward below compound eye and extending to margin of cheek; diameter of lateral ocellus 1½ times as great as length of ocellocular line.

Median half of anterior margin of pronotum ecarinate; lateral face of pronotum shagreened and with 2 or 3 short, stout rugae extending anteriorly from posterior margin; interstices of pronotum and praescutum shagreened, those of scutellum smooth; scutellum convex in lateral aspect, apical flange bidentate and slightly upturned, lateral sector of scutellar frenum with vertical rugae; hind coxa without a median tooth; outer surface of hind femur densely setose, shining; outer basal tooth of femur triangular, slightly longer than following teeth, the latter closely set and 10 in number; inner femoral tooth poorly developed, but discernible.

Gaster as in *tegularis* except that anterior band of setae across second tergum is interrupted on meson; apex of gaster short-acuminate, with dorsal surface of sixth tergum forming a 70° angle with longitudinal axis of body.

Male.—Unknown.

Type.—Female. Highlands Hammock State Park, near Sebring, Florida, Sept. 22, 1956, H. V. Weems [U.S.N.M. no. 65102].

Paratype.—GEORGIA: 1 ♀, Tifton [USNM].
Host relationships.—Unknown.

Brachymeria (Brachymeria) belfragei (Crawford)

Chalcis belfragei Crawford, 1910, Proc. Ent. Soc. Washington, 11: 205.
Brachymeria belfragei (Crawford) Peck, *in* Muesebeck *et al.*, 1951, Monog. 2, U. S. Dept. Agr., p. 586.

Female.—Length 4.0–5.0 mm. Black with mesonotum and median lobe of metanotum red; basal ⅘ of antennal scape, tegulae, bases and apices of all femora, fore and mid tibiae, spot near base and at apex of hind tibia, and all tarsi, yellow; all coxae, wing veins, and vaguely defined areas laterally on gaster, red-brown; inner surface of fore and mid tibiae may be shaded with black, and antennal club may be brown. Head and body clothed with long, dense, silvery pubescence, this forming tufts laterally on propodeum and gaster.

Antennae inserted above level of ventral margins of compound eyes; a pair of slightly irregular, oblique carinae on face extending from malar ridge to margin of scrobe cavity; dorsal margin of scrobe cavity not quite reaching anterior ocellus; ventral ⅔ of lateral scrobe margins carinate, ventral scrobe margin deflected dorsally on meson; scrobe cavity 4 times as wide as parascrobal space; apex of scape reaching apex of scrobe cavity, first funicle segment longer than wide, following segments wider than long, club slightly shorter than apical 2 funicles; clypeus 4 times as wide as long; labrum twice as wide as long; each mandible with 2 teeth, ventral tooth long and slender, dorsal tooth minute; frontal carinae absent; malar ridge extending posteriorly below eye to join lateral margin of cheek; ocellocular line ½ as long as diameter of lateral ocellus.

Median half of anterior margin of pronotum ecarinate; upper ⅔ of lateral face of pronotum with minute, irregular, longitudinal striae, a single oblique carina limiting this sculptured area ventrally, surface below carina smooth, shining; interstices on dorsum of mesonotum faintly sculptured; fore wing with stigmal vein ¼ as long as postmarginal, marginal 2¼ times as long as postmarginal; scutellum weakly convex in lateral aspect, apical flange incised on meson to form a pair of rounded teeth; lateral sector of scutellar frenum almost vertical, its surface smooth; hind coxa lacking a medium tooth; outer surface of hind femur densely setose, shining; basal tooth on outer ventral margin slightly larger than others, teeth widely spaced, varying in number from 7 to 9; inner femoral tooth wanting.

Dorsal surface of first gastral tergum smooth, shining; second tergum faintly shagreened, anteriorly 2 irregular rows of punctures extend across tergum, these rows usually interrupted narrowly on meson, laterally second tergum densely setose; sixth tergum with relatively sparse, large, setigerous punctures; gaster subacuminate at apex, dorsal surface of sixth tergum forming a 45° angle with longitudinal axis of body.

Male.—Length 4.0 mm. Color identical to female; pubescence of face slightly more dense than in female; apex of gaster more blunt than in female.

Type locality.—South Texas.

Types.—U.S.N.M. no. 12780, ♀, ♂.

Distribution.—Texas (New Braunfels, Uvalde, Brownsville); Mexico, Honduras, Panama.

Host relationships.—Unknown.

This species has been intercepted at U. S. ports of entry in banana debris from Central America. Specimens collected in Texas or Central America have no biological information associated with them.

Brachymeria (Brachymeria) fonscolombei (Dufour)
(Plate XIII, figs. 11, 12; Plate XIV, fig. 20)

Chalcis podagrica Fonscolombe, 1832, Ann. des Sci. Nat., 26: 277 [preoccupied; not *Chalcis podagrica* Fabricius].

Chalcis fonscolombei Dufour, 1841, Ann. Soc. Ent. de France, 10: 12; Crawford, 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 20; Howard and Fiske, 1911, Bul. 91, U. S. Dept. Agr., Bur. Ent., p. 241.

Brachymeria fonscolombei (Dufour) Dufour, 1841, Ann. Soc. Ent. de France 10: 16; Roberts, 1933, Ent. News, 44: 158; Roberts,* 1933, Tech. Bul. 365, U. S. Dept. Agr., 21 p.; Roberts, 1933, Ecology, 14: 311; Roberts, 1935, Jour. Agr. Res., 50: 489; Burks,* 1936, Trans. Ill. Acad. Sci., 29: 254; Weber, 1949, Proc. Hawaii. Ent. Soc., 13: 328; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587.

The above references apply to this species in the Nearctic region. *B. fonscolombei* is a species of worldwide distribution in the warm-temperate zone. The literature and synonymy of *fonscolombei* outside the Nearctic region are given by Steffan [14] and Habu.[15]

Female.—Length 4.5–6.0 mm. Black, with tegulae, apices of femora, and bases and apices of tibiae yellow; base of antennal scape, apical half to two-thirds of hind coxa, median part of each tibia, and all tarsi red, but in very small specimens these red areas tend to become brown. Head and body clothed with silvery pubescence, this more dense and composed of stouter hairs on genae, on metepisterna, and laterally on gastral terga.

Antennae inserted above level of ventral margins of compound eyes; scrobe cavity reaching anterior ocellus, lateral scrobe margins carinate throughout, ventral carina curved dorsally at interantennal projection; scrobe cavity twice as wide as parascrobal space; apex of antennal scape reaching ventral margin of anterior ocellus; pedicel as long as broad, first funicle segment longer than wide, other funicles wider than long; clypeus 4

[14] Cahiers des Nat., n. s., 15: 42, 1959.

[15] Bul. Nat. Inst. Agr. Sci. (Japan), ser. C, 11: 151, 1960.

times as wide as long, labrum twice as wide as long; each mandible with 2 teeth, ventral tooth the larger; frontal carinae present, becoming vague or obsolete before reaching level of ventral margin of compound eye; malar ridge extending below compound eye to reach lateral margin of cheek; length of ocellocular line ⅔ as great as diameter of lateral ocellus, a distinct carina usually extending from eye to lateral ocellus.

Median ⅗ of anterior margin of pronotum ecarinate; lateral face of pronotum with a strong, oblique carina, surface otherwise smooth or faintly and irregularly sculptured; interstices between umbilicate punctures on pronotum and anterior third of praescutum sculptured, elsewhere smooth; fore wing with stigmal vein ½ as long as postmarginal, marginal 3 times as long as postmarginal; scutellum usually with a narrow, longitudinal, smooth area on meson at base, scutellum in lateral aspect sub-flattened, apical flange incised on meson, lateral sector of scutellar frenum shagreened, its surface forming approximately an 80° angle with transverse axis of body; a minute, rectangular or pentagonal figure formed by short carinae on meson of metanotum just below notch in scutellar flange; hind coxa lacking a median tooth; outer surface of hind femur smooth, shining, its pubescence relatively sparse; basal femoral tooth slightly narrower but as long as largest ventral teeth, 9–12 teeth present, all except apical 3 or 4 widely spaced; inner femoral tooth present.

Dorsal surface of first gastral tergum smooth, second tergum with 2 or 3 irregular, anterior cross-rows of bristles, these rows minutely interrupted on meson, median area of second tergum posterior to rows of bristles faintly shagreened, almost smooth, sixth tergum with closely set, shallow, vaguely defined, setiferous punctures, narrow area at posterior margin of this tergum smooth and shining; gaster subacuminate at apex, dorsal surface of sixth tergum forming a 45° angle with longitudinal axis of body.

Male.—Length 3.5–5.0 mm. Color as in female, except that hind coxae are usually entirely black; gaster truncate at apex.

Type locality.—Southern France.

Types.—Lectotype ♀ and ♂ in Dufour collection, Muséum National d'Histoire Naturelle, Paris, designated by Burks.[16]

Distribution.—New Jersey south to Florida, west to Illinois, Kansas, and Arizona; Hawaii; Mexico, West Indies, Europe, North Africa, Sudan, Guinea, South and East Africa, Madagascar, Seychelles, Mongolia, China, Korea, Formosa, Japan.

Host relationships.—This is a primary parasite of blowflies and other muscoid Diptera, having been reared from *Calliphora* sp., *C. coloradensis* Hough, *Callitroga macellaria* (Fab.), *Lucilia* sp., *L. caesar* (L.), *Orthellia cornicina* (F.), *Phaenicia mexicana* (Macq.), *P. sericata* (Meig.), *Phormia regina* (Meig.),

[16] Trans. Ill. Acad. Sci., 29: 254, 1936.

Sarcophaga sp., *S. carnaria* (L.), *S. haemorrhoidalis* (Fall.), *S. impar* (Ald.), *S. lineata* (Fall.), *S. plinthopyga* Wied., *Synthesiomyia nudiseta* (V. D. Wulp).

Brachymeria (Brachymeria) mexicana (Dalla Torre) (Plate XII, fig. 4)

Chalcis pubescens Walker, 1871, Notes on Chalc., pt. 3, p. 47; Cresson, 1872, Trans. Amer. Ent. Soc., 4: 59; Cameron, 1884, Biol. Cent.-Amer., Ins., Hym., v. 1, p. 99 [preoccupied; not *Chalcis pubescens* Klug, 1834].

Chalcis mexicana Dalla Torre, 1898, Cat. Hym., v. 5, p. 389 [species renamed]; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 27.

Brachymeria mexicana (Dalla Torre) Rau, 1940, Ann. Ent. Soc. Amer., 33: 594; Rau, 1941, Ann. Ent. Soc. Amer., 34: 365.

This species is not known to occur in America north of Mexico, but it has been included here because it is intercepted often at U. S. ports of entry in shipments of bananas from Central or South America. The head and body are black, conspicuously clothed with dense and coarse, golden pubescence; frontal carinae are absent, but the malar ridge extends beneath the eye to join the lateral margin of the cheek; there is an oblique ridge extending from the base of the compound eye to the lower outer angle of the scrobe cavity; the apex of the scutellum is bidentate; the hind femur has a dorsal and basal yellow stripe, the outer basal tooth is slightly larger than those following, and the inner tooth is absent; the apex of the female gaster is subacuminate.

Type locality.—Mexico.

Types.—Muséum National d'Histoire Naturelle, Paris, Lectotype ♀ and 1 ♀ paratype, so labeled by J. R. Steffan; designation not previously published.

Distribution.—Mexico south to Venezuela, Ecuador, and Peru.

Host relationships.—Apparently a primary parasite of *Trypoxylon mexicanum* Saussure and *Trypoxylon* sp.

Brachymeria (Brachymeria) russelli new species (Plate XII, fig. 5; Plate XIV, fig. 23)

This species differs from all others which have the malar ridge deflected backward beneath the compound eye in having the lateral ocelli set in pits.

Female.—Length 4.0–5.0 mm. Black, with tegulae mostly, apices of femora, entire fore and mid tibiae except for a small, median spot on inner

face of each, spot near base and apex of hind tibia, and all tarsi, yellow; apex of antennal club and wing veins red-brown. Pubescence relatively short and sparse, silvery.

Antennae inserted above level of ventral margins of compound eyes; scrobe cavity reaching anterior ocellus, ventral ⅔ of lateral scrobe margins strongly carinate, ventral margin carinate, this carina deflected dorsally on meson; scrobe cavity 4 times as wide as parascrobal space; antennal scape reaching apex of scrobe; antennal pedicel elongate, pedicel ⅔ as long as first funicle segment and as long as second; third and following funicles wider than long, club as long as apical 2 funicles; clypeus flat, smooth, 4 times as wide as long; labrum smooth, shining, its length ½ its width; each mandible with 2 blunt teeth; frontal carinae absent; malar ridge deflected backward below compound eye and extending to posterior margin of cheek; lateral ocellus set in a shallow pit (Plate XII, fig. 5); length of ocellocular line ⅗ as great as diameter of lateral ocellus.

Median third of anterior margin of pronotum ecarinate; lateral face of pronotum with 2 strong, oblique cross-rugae; interstices between umbilicate punctures of entire thoracic dorsum sculptured; fore wing with postmarginal vein 3 times as long as stigmal; scutellum truncate at apex, apical flange bidentate, these teeth slightly upturned; lateral sector of scutellar frenum with strong, vertical rugae, surface at anterior apex shagreened; hind coxa without a median tooth; outer surface of hind femur densely setose, reticulate, mat; basal femoral tooth slightly larger than following ones, 10–12 teeth present; inner femoral tooth poorly developed, but usually discernible.

Dorsal surface of first gastral tergum smooth, shining; second tergum setose laterally, median area shagreened; sixth tergum with dense, anastomosing pits; gaster truncate at apex, sixth tergum lying slightly farther posteriorly than seventh.

Male.—Length 4.0–5.0 mm. Color, pubescence, and sculpture as in female; both fifth and sixth gastral terga lying farther posteriorly than seventh.

Type locality.—Upton, New Mexico.

Type.—Female. Upton, New Mexico, Aug. 20, 1952, emerged from larvae of *Coptocycla* (*Psalidonota*) *texana* (Schaeffer) on morning glory, J. H. Russell [U.S.N.M. no. 65103].

Allotype.—Male; same data [USNM].

Paratypes.—ARIZONA: 1 ♀, Canelo, Aug. 3, 1956, G. D. Butler [UA]. MISSISSIPPI: 1 ♀, 1 ♂, Agr. College, Aug. 31, 1920, reared from larvae of *Chelymorpha cassidea* (Fab.), J. M. Langston. NEW MEXICO: 22 ♀, 10 ♂, same data as type. TEXAS: 2 ♂, Brownsville, Apr. 5, 1938, reared from *Coptocycla* (*Psalidonota*) *texana*, E. P. Regan; 2 ♀, 1 ♂, Brownsville, Apr.

13, 1938, reared from larvae of *Nuzonia* sp. MEXICO: 1 ♀, Coahuila (Laredo, Tex. P. O. E.), Jan. 10, 1942, on lettuce, J. J. Watt.

One ♀ paratype deposited in the University of Arizona collection, Tucson; the others are in the U. S. National Museum.

Host relationships.—This apparently is a primary parasite of the larvae of leaf beetles belonging to the subfamily Cassidinae.

Brachymeria (Brachymeria) aeca new species

This species agrees with *russelli* new species, in having the apex of the gaster truncate with tergum six projecting farther posteriorly than tergum seven, but *aeca* does not have the lateral ocelli set in pits and the frontal carinae are present.

Female.—Length 2.5–5.0 mm. Black, with the following yellow: Tegulae, apices of femora, most or all of fore tibiae, bases and apices of mid and hind tibiae, and tarsi; apices of mandibles, antennal radicle and club, and, often, mid trochanters dark brown. Pubescence silvery, a tuft of hair on interantennal projection.

Antennae inserted slightly above level of ventral margins of compound eyes; scrobe cavity not quite reaching anterior ocellus, lateral scrobe margins completely carinate, ventral carina deflected dorsally and minutely interrupted on meson; scrobe cavity 2⅔ times as wide as parascrobal space; apex of antennal scape slightly exceeding apex of scrobe cavity; pedicel and all funicle segments broader than long, club as long as apical 2 funicles; clypeus and labrum each 2½ times as broad as long; each mandible with 2 teeth, ventral one the larger; frontal carinae present; malar ridge extending below compound eye to reach lateral margin of cheek; length of ocellocular line equal to diameter of lateral ocellus.

Median third of anterior margin of pronotum ecarinate; lateral face of pronotum shagreened; all interstices of dorsum of thorax sculptured; fore wing with stigmal vein half as long as postmarginal, marginal 3½ times as long as postmarginal; scutellum strongly convex in lateral aspect, broad and semi-quadrate at apex, apical flange broad, emarginate at meson; scutellar frenum minutely shagreened and with 2 or 3 vertical rugae located toward posterior apex; hind coxa without median tooth; hind femur outwardly clothed with dense, recumbent pubescence, surface sculptured, mat; outer basal tooth slightly larger than following ones, 10–11 teeth present; inner femoral tooth present, but poorly developed.

Dorsal surface of first gastral tergum smooth, shining; second tergum setose laterally, mesal area shagreened; sixth tergum shagreened and bearing closely set, incomplete, setigerous punctures; gaster truncate at apex, in normal position sixth tergum lying farther posteriorly than apex of ovipositor.

Male.—Length 3.0–5.0 mm. Color and pubescence as in female; inner tooth of hind femur faint or wanting; shagreening on median area of second gastral tergum faint; sixth gastral tergum lying farther posteriorly than apical sternal plate.

Type locality.—Oak Ridge, Tennessee.

Type.—Female. A.E.C. controlled area, Oak Ridge, Tennessee, Aug. 27, 1956, sweeping weeds, H. F. Howden [U.S.N.M. no. 65104].

Allotype.—Male. Covington, Georgia, May 17, 1933, P. W. Fattig [USNM].

Paratypes.—ALABAMA: 1 ♀, Jackson, Apr. 19, 1910, W. D. Pierce. BRITISH COLUMBIA: 1 ♀, Lillooet, Apr. 30, 1949, reared from undetermined tachinid puparium from unknown lepidopterous host on *Pseudotsuga* [CDA]. FLORIDA: 1 ♀, Hanover, Mar. 19, no. 117 [ANSP]; 2 ♀, Jacksonville, Apr. 25, 1914; 2 ♂, Paradise Key, Mar. 22, 1954, K. V. Krombein. GEORGIA: 4 ♀, Atlanta, May–Aug., P. W. Fattig. MAINE: 2 ♀, Bonny Eagle, July 24, 1929. NEW JERSEY: 1 ♂, Anglesea, May 31 [ANSP]. NEW MEXICO: 1 ♀, Las Cruces, 736, T. D. A. Cockerell. NEW YORK: 1 ♂, Ithaca, June 9, 1947, W. Mason [CDA]; 1 ♀, 1 ♂, Oswego, Aug. 1, 1897; 1 ♀, Powder Mills, July 25, 1954, reared from undetermined tachinid parasite of lepidopterous larval prey in nest of *Rygchium foraminatum* (Sauss.), K. W. Cooper. NOVA SCOTIA: 1 ♀, Kentville, July 21, 1924, R. P. Gorham [CDA]; 3 ♀, White Point Beach, Queen Co., Aug. 22, 1936, attacking larvae of *Cingilia catenaria* Dru., J. McDunnough [CDA]. ONTARIO: 1 ♀, Dwight, Mar. 28, 1939, associated with larvae of *Pikonema alaskensis* (Roh.), F. I. Survey, 1938, no. 5054[CDA]; 1 ♂, Kapuskasing, Mar. 28, 1947, associated with noctuid moth, no. 4674 [CDA]; 1 ♂, Kapuskasing, Apr. 30, 1947, from tachinid puparium, no. 4781 [CDA]; 2 ♀, Mer Bleue, Aug. 9, 1932, G. S. Walley [CDA]; 1 ♀, Mer Bleue, July 25, 1932, L. J. Milne [CDA]; 1 ♂, Mine Centre, reared from *Chaetophlepsis*, sp., parasite on *Nepytia canosaria* (Walk.), no. 8762 [CDA]; 1 ♂, Sault Ste. Marie, Apr. 30, 1947, reared from *Chaetophlepsis* puparium, no. 4780 [CDA]. QUEBEC: 1 ♀, Abbotsford, June 22, 1937, G. Shewell [CDA]. SASKATCHEWAN: 1 ♀, Willow Bunch, July 28, 1955, C. D. Miller [CDA]. TEXAS: 1 ♀, Brownsville; 1 ♀,

Del Rio, Apr. 25, 1959, W. Mason [CDA]; 1 ♀, Kerrville, June 19, 1907, F. C. Pratt. WISCONSIN: 1 ♂, Cranmoor, Aug. 8, 1910, C. W. Hooker.

Two ♂ paratypes deposited in the Academy of Natural Sciences of Philadelphia, and 12 ♀, 5 ♂ paratypes deposited in the Canadian Department of Agriculture collections, Ottawa; the others are in the U. S. National Museum.

Host relationships.—This species is a secondary parasite of lepidopterous and, possibly, tenthredinid larvae.

Brachymeria (Brachymeria) hammari (Crawford) (Plate XII, fig. 2)

Chalcis hammari Crawford, 1915, Ins. Ins. Mens., 3: 89.
Brachymeria hammari (Crawford) Bottimer, 1926, Jour. Agr. Res., 33: 814; Swezey, 1946, Bul. 189, Bernice P. Bishop Mus., p. 212; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587; Burks, *in* Krombein *et al.* 1958, Monog. 2, Supp., U. S. Dept. Agr., p. 83.

Female.—Length 3.0–4.5 mm. Black, with tegulae, apices of femora, bases and apices of tibiae, and tarsi yellow; teeth of mandibles and antennal radicle and club red-brown. Pubescence silvery.

Antennae inserted slightly above level of ventral margins of compound eyes; scrobe cavity reaching anterior ocellus, lateral scrobe margins carinate, carina at ventral scrobe margin deflected dorsally on meson; scrobe cavity 3½ times as wide as parascrobal space; apex of antennal scape not quite reaching apex of scrobe cavity; pedicel as wide as long, first funicle longer than wide, second funicle as wide as long, following funicles wider than long, club as long as apical 2 funicles; clypeus 4 times as wide as long, labrum twice as wide as long; left mandible with 2 broad teeth, ventral one slightly the larger, right mandible with 3 teeth; frontal carinae absent or faintly indicated; a pair of vertical rugae on face beneath scrobe cavity (Plate XII, fig. 2); malar ridge extending beneath eye to join lateral margin of cheek; diameter of lateral ocellus twice as great as length of ocellocular line.

Median ⅖ of anterior margin of pronotum ecarinate; lateral face of pronotum shagreened, one stout, oblique cross-ruga present in ventral third; interstices of entire dorsal surface of thorax sculptured; fore wing with postmarginal vein twice as long as stigmal, marginal twice as long as postmarginal; scutellum almost flat in lateral aspect, apical flange narrow, entire; lateral sector of scutellar frenum almost vertical, its surface minutely sculptured and with 7 or 8 short, vertical rugae extending from ventral margin; hind coxa without a median tooth; outer surface of hind femur densely hairy, sculptured and mat, outer basal tooth slightly larger than following ones, 12–14 teeth present; inner femoral tooth vague or absent.

Dorsal surface of first gastral tergum usually shagreened, in some speci-

mens this sculpture faint or absent; second gastral tergum setose laterally and with a narrow, irregular band of setose pits extending across tergum at anterior margin, median area posterior to this cross-band of setae shagreened; sixth tergum with numerous, closely set, shallow, setigerous pits, most of these pits incomplete posteriorly; gaster subacuminate at apex, dorsal surface of sixth tergum forming a 45° angle with longitudinal axis of body.

Male.—Length 2.5–4.0 mm. Color, sculpture, and pubescence as in female; gaster truncate at apex.

Type locality.—Roswell, New Mexico.

Types.—U.S.N.M. no. 19639, ♀, ♂.

Distribution.—Arkansas, Kansas, and Texas west to Oregon and California.

Host relationships.—This species apparently is a primary parasite of Lepidoptera, having been reared from the pupae of *Ancylis comptana fragariae* (W. & R.), *Archips argyrospilus* (Walk.), *Argyrotaenia citrana* (Fern.), *Carpocapsa pomonella* (L.), *Filatima monotaeniella* (Bott.), *Platynota stultana* (Wlshm.), *Psorosina hammondi* (Riley). A single specimen was, however, said to have been reared from the cocoon of the icheumonid *Cremastus cookii* Weed.

Brachymeria (Brachymeria) molestae new species

This species long has been confused with *hammari* (Crawford), but it lacks the vertical rugae on the face beneath the antennal sockets, characteristic of *hammari*, and the shagreened first gastral tergum, usually present in *hammari*, is never present in *molestae*.

Female.—Length 2.5–3.5 mm. Black, with antennal radicle, apex of scape, ventral side of club, tegula, second trochanter of each leg, apices of femora, bases and apices of tibiae, and tarsi light tan to yellow; darkened area of anterior tibia often greatly reduced; mandibular teeth and wing veins brown. Pubescence silvery.

Antennae inserted slightly above level of ventral margins of compound eyes; scrobe cavity not reaching anterior ocellus, lateral scrobe margins carinate throughout, carina at ventral margin deflected dorsally on meson; scrobe cavity 3 times as wide as parascrobal space; apex of antennal scape reaching apex of scrobe cavity; pedicel longer than wide, all funicle segments wider than long, club 1⅕ times as long as apical 2 funicles; clypeus 4 times as wide as long, labrum twice as wide as long; left mandible with 2 blunt teeth, right with 3; frontal carinae absent; malar ridge extending

below compound eye to join lateral margin of cheek; length of ocellocular line ⅗ as great as diameter of lateral ocellus.

Median half of anterior margin of pronotum ecarinate; lateral face of pronotum shagreened, one oblique cross-ruga present near ventral margin; interstices between umbilicate punctures of entire thoracic dorsum sculptured; fore wing with postmarginal vein twice as long as stigmal, marginal 3 times as long as post marginal; scutellum almost flat in lateral aspect, apical flange narrow, entire; lateral sector of scutellar frenum vertical, its surface shagreened and with 6–8 short, vertical rugae extending from ventral margin; hind coxa lacking a median tooth; hind femur outwardly with dense, short pubescence, surface sculptured, dull; basal tooth on ventral margin the same length as median ones, 10–12 teeth present; inner femoral tooth faint or absent.

Dorsal surface of first gastral tergum smooth, shining; second tergum laterally setose, median area asetose and faintly shagreened, almost smooth; sixth tergum with numerous, minute, shallow, setose pits; gaster subacuminate at apex, surface of sixth tergum forming a 45° angle with longitudinal axis of body.

Male.—Length 2.5–3.0 mm. Color, pubescence, and sculpture as in female; gaster truncate at apex.

Type locality.—Clemson, South Carolina.

Type.—Female. Clemson College, South Carolina, Sept. 19, 1934, reared from pupa of *Grapholitha molesta* (Busck), O. L. Cartwright [U.S.N.M. no. 65105].

Allotype.—Male. Same data [USNM].

Paratypes.—DISTRICT OF COLUMBIA: 1♀, May 1872, 504 [specimen determined as *Chalcis ovata* Say, var. 1, by Cresson, 1880]. FLORIDA: 1♀, 1♂, Alachua Co., Sept. 30, 1958, reared from *Anchylopera platanana* Clem., H. A. Denmark; 1♀, Buena Vista, Aug. 14, 1913, E. R. Sasscer; 1♀, Clarcona, Sept. 25, 1930, reared from lepidopterous pupa on grapefruit, F. H. Benjamin; 1♀, Clewiston, Aug. 1946, W. D. Wylie; 1♀, Gainesville, 1929, reared from leaf-tyer on *Acacia*, T. L. Cain, Jr.; 1♀, 2♂, Sanford, June 12, 1926, collected on corn, W. E. Stone. GEORGIA: 1♀, 4♂, Atlanta, Aug. 11–18, 1924, reared from pupae of *Grapholitha molesta*, J. Chaffin. INDIANA: 1♀, Vincennes, Summer 1956, in apple orchard. MARYLAND: 1♂, College Park, Aug. 9, 1934, reared from *Arogalea cristifasciella* (Chamb.), H. S. McConnell. MISSISSIPPI: 1♀, Utica, Aug. SOUTH CAROLINA: 3♀, 4♂, Clemson College, Sept. 10–28, 1932, reared from pupae of *Grapholitha molesta*, W. C. Nettles;

3 ♀, 1 ♂, Clemson College, Sept. 16–20, 1934, reared from pupae of *Grapholitha molesta*, O. L. Cartwright. TENNESSEE: 1 ♀, Knox Co., Oct. 8, 1956, reared from *Ancylis comptana* (Froel.), Bennett. VIRGINIA: 2 ♀, Blacksburg, 1950, reared from *Anchylopera platanana* on sycamore. [All specimens USNM.]

Host relationships.—This species presumably is a primary parasite of Lepidoptera, although the specimens included above from Sanford, Florida, on corn, are associated with ichneumonid cocoons.

Brachymeria (Brachymeria) compsilurae (Crawford)
(Plate XII, fig. 6; Plate XIII, fig. 8)

Chalcis compsilurae Crawford, 1911, Proc. U. S. Natl. Mus., 41: 272; Howard and Fiske, 1911, Bul. 91, U. S. Dept. Agr., Bur. Ent., p. 240.

Brachymeria compsilurae (Crawford) Gahan, Crosby, and Leonard, *in* Leonard 1928, Mem. 101, Cornell Univ. Agr. Expt. Sta., p. 976; Knull, 1932, Jour. Econ. Ent., 25: 1202; Proper, 1934, Jour. Agr. Rec., 48: 370–374; Dowden,* 1935, Jour. Agr. Res., 50: 495; Burks,* 1936, Trans. Ill. Acad. Sci., 29: 254; Salt, 1941, Cambridge Phil. Soc., Biol. Rev., 16: 253, 255; Brown, 1941, Pub. 712, Canada Dept. Agr., p. 6; Flanders, 1944, Jour. Econ. Ent., 37: 409; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587; Burks, *in* Krombein *et al.* 1958, Monog. 2, Supp., U. S. Dept. Agr., p. 83.

Female.—Length 4.0–7.0 mm. Black, with tegulae, apices of femora, bases and apices of tibiae, and tarsi yellow; antennal club, median spot on fore tibia, and wing veins brown. Pubescence silvery.

Antennae inserted above level of ventral margins of compound eyes; scrobe cavity extending to anterior ocellus, ventral ⅕ of lateral scrobe margins carinate, ventral carina deflected dorsally on meson; scrobe cavity 3 times as wide as parascrobal space; apex of antennal scape not quite reaching apex of scrobe; pedicel as broad as long, all funicle segments broader than long, club as long as apical 2 funicles; clypeus 4 times as wide as long, labrum twice as wide as long; each mandible with 2 teeth, ventral one broader and longer than dorsal one; frontal carinae present, extending from malar ridge to a point ¾ the eye height; malar ridge extending below compound eye to join lateral margin of cheek; diameter of posterior ocellus and length of ocellocular line equal, space between lateral ocellus and compound eye shagreened.

Median third of anterior margin of pronotum ecarinate; lateral face of pronotum faintly shagreened dorsally, smooth and shining ventrally, in middle area 2 or 3 short, oblique and irregular rugae present; interstices of thoracic dorsum sculptured and dull anteriorly, becoming smooth and shining at midpoint of mesoscutum, all on scutellum smooth; fore wing with postmarginal vein twice as long as stigmal, marginal 2½ times as long as

postmarginal; scutellum convex in lateral aspect, a vaguely defined, median, longitudinal depression present in apical half, apical flange broad, slightly upturned, and deeply emarginate on meson; lateral sector of scutellar frenum forming a 50° angle with transverse axis of body, surface faintly sculptured, almost smooth, 3 or 4 vertical rugae present posteriorly; hind coxa without a median tooth; outer surface of hind femur smooth, shining, pubescence fine and decumbent; basal tooth on ventral margin equal in size to the largest of the other teeth, 9–10 teeth present; inner femoral tooth absent.

Dorsal surface of first gastral tergum smooth, shining; second tergum setose laterally, 2 irregular, medianly interrupted, anterior cross-rows of setose pits present, median area of tergum posterior to these faintly shagreened, posterior margin of tergum shallow-concave; sixth tergum with closely set, but discrete setigerous punctures; gaster subacuminate at apex.

Male.—Length 3.5–6.0 mm. Color, sculpture, and pubescence as in female; gaster normally truncate at apex.

Type locality.—Wisconsin.

Types.—U.S.N.M. no. 13802, ♀, ♂.

Distribution.—Maine, New Hampshire, and Ontario south to North Carolina and Tennessee, west through Michigan, Illinois, Wisconsin, Minnesota, Manitoba, and Montana, to Oregon and British Columbia; in western mountains south to Colorado and New Mexico.

Host relationships.—This is a secondary parasite of Lepidoptera; it has been reared from *Achaetoneura aletiae* (Riley), *A. frenchii* (Will.), *Carcelia amplexa* (Coq.), *C. laxifrons* Vill., *Compsilura concinnata* (Meig.), *Exorista larvarum* (L.), *Pelatachina pellucida* (Coq.), *Phorocera agilis* R.-D., *P. claripennis* Macq., *Sturmia nidicola* Towns., *S. scutellata* (R.-D.), *Rileymyia fulvipes* (Bigot). Records have been published of *compsilurae* having been a primary parasite of lepidopterous or tenthredinid larvae, but those records can safely be disregarded, as careful rearing has shown this species to be a hyperparasite.[17]

Brachymeria (Brachymeria) carinatifrons Gahan

Brachymeria carinatifrons Gahan, 1936, Proc. Ent. Soc. Washington, 37: 165; Landis and Howard, 1940, Tech. Bul. 721, U. S. Dept. Agr., p. 7; Berry and Parker, 1949, Proc. Ent. Soc. Washington, 51: 101.

B. carinatifrons is not known to occur in North America north of Mexico, but it has been included here because it may have

[17] Dowden, Jour. Agr. Res., 50: 509, 1935.

been introduced with its host. This species is very closely related to *compsilurae* (Crawford), as it has frontal carinae, the malar carina extends beneath the compound eye and reaches the lateral margin of the cheek, the right mandible has 2 teeth, the ventral one of which is larger than the dorsal one, the interstices of the posterior half of the thoracic notum are smooth and shining, the outer surface of the hind femur is shining, the inner femoral tooth is absent, the first gastral tergum is smooth dorsally, the second tergum is faintly sculptured in the median area, and the gaster is subacuminate at the apex. They differ in that in *carinatifrons* the space between the lateral ocellus and the compound eye has umbilicate punctation and the scutellum does not have a median, longitudinal depression in the apical half.

Type locality.—Cuernavaca, Morelos, Mexico.

Types.—U.S.N.M. no. 51199, ♀, ♂.

Distribution.—Mexico, Brazil.

Host relationships.—This is a secondary parasite of coccinellid beetles of the genus *Epilachna*, through the tachinids *Paradexodes epilachnae* Ald. and *Lydinolydella metallica* Towns. The former was introduced into the United States for biological control of *Epilachna*.

Brachymeria (Brachymeria) intermedia (Nees)

Chalcis intermedia Nees, 1834, Hym. Ichn. affin. Monogr., v. 2, p. 29.

Chalcis flavipes, not Fabricius, not Panzer, Crawford, 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 18 [misdetermined]; Howard and Fiske, Bul. 91, U. S. Dept. Agr., Bur. Ent., p. 240; Masi, 1916, Ann. Mus. Civ. Stor. Nat. Genova, ser. 3, 7: 78.

Brachymeria intermedia (Nees) Burgess and Crossman, 1929, Tech. Bul. 86, U. S. Dept. Agr., p. 116; Dowden, 1935, Jour. Agr. Res., 50: 497; Burks, 1960, Ent. News, 71: 62.

The citations above are those applying to this species in North America; the Palearctic literature (including a lengthy synonymy) is given in Ruschka, 1922.[18] Recent treatments of *intermedia* in the Palearctic region are given by Bouček[19] and Steffan.[20]

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[18] Konowia, 1: 225, 1922.
[19] Acta Ent. Mus. Nat. Prag., 27 (Supp. I): 22, 1951.
[20] Cahiers des Nat., n. s., 15: 38, 1959.

Large scale liberations of this species were made in New England during the period 1905 to 1933 for conrtol of the Gypsy moth, but it was thought not to have become established. In 1942, however, a single female of *intermedia* was reared at Marion, Mass., from a native *Cacoecia* pupa. This one record is insufficient to demonstrate that *intermedia* has indubitably been established in North America. It is to be hoped that additional specimens will be reared in North America.

In *B. intermedia* the head and body are black with the tibiae almost entirely yellow; the frontal carinae are absent; the malar carina extends beneath the compound eye, but does not quite reach the lateral margin of the cheek; the interstices between the umbilicate punctures of the posterior half of the dorsum of the thorax are smooth and shining; the female hind coxa has a median tooth; the outer surface of the hind femur is shining and the inner tooth is wanting; the first gastral tergum is smooth dorsally; the second tergum has an irregular, usually medianly interrupted, anterior cross-band of setae, with the median area posterior to this minutely sculptured; and the apex of the gaster is subtruncate. In most specimens of both sexes the median sector of the seventh gastral tergum, including the cerci, is dark red-brown rather than black.

Type locality.—Sickershausen, Germany.

Types.—Probably lost.

Distribution.—Europe, Mediterranean region, Asia Minor, Middle-East, Iraq, Iran, Turkmen S. S. R.; ?Massachusetts.

Host relationships.—This is a primary parasite of the pupae of Lepidoptera belonging to at least 10 families. It will, under exceptional circumstances, also parasitize muscoid puparia.

Brachymeria (Brachymeria) coloradensis (Cresson)

(Plate XIII, figs. 9, 17)

Chalcis coloradensis Cresson,* 1872, Trans. Amer. Ent. Soc., 4: 60; Howard, 1885, Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 36; Cresson, 1887, Trans. Amer. Ent. Soc., Supp. vol., p. 234; Dalla Torre, 1898, Cat. Hym., v. 5, p. 387; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 26; Crawford,* 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 16; Girault, 1917, Descr. Stell. Nov., p. 6.

Brachymeria coloradensis (Cresson) Burks,* 1936, Trans. Ill. Acad. Sci., 29: 253; Burks, 1940, Trans. Ill. Acad. Sci., 33: 208; Peck, *in* Muesebeck *et*

al. 1951, Monog. 2, U. S. Dept. Agr., p. 586; Smith, 1957, Canad. Jour. Zool., 36: 258; Burks, *in* Krombein *et al.* 1958, Monog. 2, Supp., U. S. Dept. Agr., p. 83.

Chalcis tachinae Howard,* 1885, Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 8, 32, 36; Dalla Torre, 1898, Cat. Hym., v. 5, p. 393; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 28; Crawford, 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 16; Girault, 1917, Descr. Stell. Nov., p. 6. New Synonymy.

Brachymeria tachinae (Howard) Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587.

The above citations apply to this species in North America. *B. coloradensis* is a Holarctic species with a long list of synonyms in the Palearctic literature; *see* Steffan [21] and Habu [22] for these.

Female.—Length 3.0–5.5 mm. Black, with spot as base of antennal scape, tegulae, apices of femora, and bases and apices of tibiae yellow; mandibular teeth, apex of antennal club, apex of hind coxa, basal parts of all femora, middle parts of all tibiae, and tarsi bright red-tan; in approximately three per cent of female specimens the red-tan areas of fore and mid femora and tibiae and of the hind femora are more or less shaded with black. Pubescence silvery.

Antennae inserted slightly above level of ventral margins of compound eyes; scrobe cavity not quite reaching anterior ocellus, lateral margins of scrobe cavity carinate, carina at ventral scrobe margin deflected dorsally at meson; scrobe cavity 2½ times as wide as parascrobal space; apex of antennal scape reaching apex of scrobe cavity; pedicel as long as wide, first funicle segment slightly longer than wide, following funicles wider than long, club slightly longer than apical 2 funicles; clypeus densely punctured and 2¾ times as wide as long, labrum twice as wide as long; each mandible with 2 teeth, dorsal one the smaller; frontal carinae absent; malar ridge extending below compound eye to join lateral margin of cheek; length of ocellocular line 1½ times as great as diameter of lateral ocellus.

Median third of anterior margin of pronotum ecarinate; lateral face of pronotum dorsally sculptured, this tending to form parallel, longitudinal striae, a single, oblique cross-ruga located near ventral margin; interstices of dorsum of thorax smooth; fore wing with postmarginal vein twice as long as stigmal, marginal vein 2¼ times as long as postmarginal; scutellum convex in lateral aspect, apical flange with a broad and deep, median emargination; lateral sector of scutellar frenum shagreened anteriorly, posteriorly with 4–6 vertical rugae; hind coxa without a median tooth; outer surface of hind femur sculptured, subshining, basal tooth on ventral margin equal in length to largest following teeth, 10–12 teeth present, inner tooth present.

[21] Cahiers des Nat., n. s., 15: 42, 1959.
[22] Bul. Nat. Inst. Agr. Sci. (Japan), Sec. C, 11: 159, 1960.

Dorsal surface of first gastral tergum smooth, second tergum laterally setose, broad mesal area at anterior margin asetose, median area posteriorly smooth or nearly so; sixth tergum with large, discrete, setigerous punctures; gaster subacuminate at apex.

Male.—Length 3.5–5.5 mm. Black, with spot at base of antennal scape, tegulae, apices of femora, bases and apices of tibiae, and tarsi yellow; mandibular teeth, ventral side of antennal funicle and club, and middle parts of fore and hind tibiae red-tan; sometimes middle parts of all tibiae shaded with black, and often a narrow red-tan band is present at apex of black area of hind femur. Gaster truncate at apex.

Type locality.—Colorado.

Type.—Academy of Natural Sciences of Philadelphia, no. 1826, ♀.

Distribution.—Holarctic; in North America, New Hampshire and Ontario, west to British Columbia, south to Florida, Texas, Arizona, and California.

Host relationships.—*B. coloradensis* is a secondary parasite of grasshoppers, having been reared from puparia of *Sarcophaga kellyi Ald.* and *S. hunteri* Hough, as well as from other, undetermined Sarcophagidae from grasshoppers. It is commonly collected in xeric habitats where grasshoppers are numerous.

Brachymeria (Brachymeria) slossonae (Crawford)

Chalcis slossonae Crawford, 1910, Proc. Ent. Soc. Washington, 11: 205; Crawford, 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 15.

Brachymeria slossonae (Crawford) Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587; Tamburo and Butcher, 1955, Fla. Ent., 38: 68.

Female.—Length 6.0 mm. Color variable: Type black with tegulae, apices of femora, bases and apices of tibiae, fore and mid tarsi and basal 4 segments of hind tarsus yellow; darkened areas of fore and mid femora and of all tibiae, and apical segment of hind tarsus chocolate brown; apices of mandibles, trochanters, hind coxae, and all but apex of hind femur, middle part of hind tibia, and lateral and ventral areas of gaster red-brown. In other specimens, antennal scape, basal parts of fore and mid femora, and entire gaster brown-red; or, in others, darkened areas of fore and mid femora and all tibiae black; in darkest specimens only dorsal and basal areas of hind femora brown-red. Pubescence golden in all specimens; head pubescence conspicuously long and dense on frons and genae.

Antennae inserted slightly above level of ventral margins of compound eyes; apex of scrobe cavity reaching anterior ocellus, ventral ¾ of lateral scrobe margins carinate, carina at ventral margin of scrobe cavity deflected

dorsally at meson; scrobe cavity 3½ times at wide as parascrobal space; apex of antennal scape not quite reaching apex of scrobe cavity; pedicel twice as wide as long, first funicle segment 1½ times as long as broad, second funicle as long as broad, following funicles becoming progressively shorter, so that seventh is 1½ times as broad as long, club ⅗ as long as apical 2 funicles; clypeus 4 times as broad as long, its surface smooth and with a row of 6–8 bristles located at dorsal margin; labrum twice as broad as long; left mandible with 2 teeth, ventral one the larger, right mandible with 3 teeth which are subequal in size; frontal carinae absent, malar ridge ending at compound eye; diameter of posterior ocellus twice as great as length of ocellocular line.

Median half of anterior margin of pronotum ecarinate; lateral face of pronotum dorsally with minute, coriaceous sculptures, ventrally one broad, oblique furrow with 1 or 2 minute cross-rugae present; fore wing with marginal vein twice as long as postmarginal, stigmal half as long as postmarginal; scutellum almost flat in lateral aspect, apical flange emarginate on meson; lateral sector of scutellar frenum anteriorly smooth, posteriorly with 2 or 3 vertical rugae; hind coxa with a median tooth; outer surface of hind femur minutely sculptured, dull, basal tooth more than 3 times as large as any following teeth, 9–12 teeth present; inner femoral tooth absent.

Dorsal surface of first gastral tergum smooth; second tergum asetose in broad median area, a few, scattered setae laterally, surface minutely sculptured; sixth tergum with poorly defined, setigerous punctures; gaster subacuminate at apex.

Male.—Length 4.5–5.5 mm. Showing the same color variations as the female; pubescence of head more sparse than in female; apex of gaster subtruncate.

Type locality.—Biscayne Bay, Florida.

Types.—U.S.N.M. no. 12779, ♀, ♂.

Distribution.—Southern Florida, Miami south through Keys.

Host relationships.—This presumably is a primary parasite of Lepidoptera; it has been reared from the pupae of *Ephyriades brunnea floridensis* B. & C.

Brachymeria (Brachymeria) incerta (Cresson)

Chalcis incerta Cresson,* 1865, Proc. Ent. Soc. Philadelphia, 4: 101; Howard, 1885, Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 36; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 26; Crawford,* 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 14, 16; Wolcott, 1922, Jour. Dept. Agr. P. R., 6: 10; Cleare, 1923, Jour. Bd. Agr. Brit. Guiana, 16: 40; Wolcott,* 1924, Jour. Dept. Agr. P. R., 7: 56; Cleare, 1924, Jour. Bd. Agr. Brit. Guiana, 17: 161; Ruhl, 1927, Soc. Ent., 42: 40; Myers, 1931, Empire Mkt. Bd. Pubs. 42, p. 133; Myers, 1935, Bul. Ent. Res., 26: 242.

Brachymeria incerta (Cresson) Waterston, 1923, Bul. Ent. Res., 14: 104;

Cleare and Squire, 1934, Agr. Jour. Brit. Guiana, 5: 190; Wolcott, 1936, Jour. Agr. Univ. P. R., 20: 535; Fife, 1939, Bul. 39, P. R. Expt. Sta., p. 6; Martorell, 1940, Carib. For., 2: 19; Fennah, 1947, Ins. pests of food crops in Lesser Antilles, B. W. I. Dept. Agr. Windward and Leeward Is., p. 148; Wolcott,* 1948, Jour. Agr. Univ. P. R., 32: 803; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587; Lordello, 1952, An. Esc. Sup. de Agr. Luiz de Queiroz, 9: 24.

Female.—Length 5.0–7.0 mm. Black, with tegulae, apices of femora, bases and apices of tibiae, all but claws of fore and mid tarsi, and basal 4 segments of hind tarsus, creamy white to yellow. Pubescence silvery, that on frons, axillae, and at apex of scutellum longer and more dense than elsewhere; a tuft of pubescence on interantennal process.

Antennae inserted slightly dorsal to level of ventral margins of compound eyes; scrobe cavity reaching anterior ocellus, ventral ¾ of lateral scrobe margins carinate, ventral carina deflected dorsally and minutely interrupted on meson; scrobe cavity 4 times as wide as parascrobal space; antennal scape slightly exceeding apex of scrobe cavity, pedicel twice as wide as long, first funicle 1⅓ times as long as wide, second slightly shorter than first, funicles becoming progressively shorter but no wider toward apex, seventh funicle as long as wide, club ⅔ as long as apical 3 funicles; clypeus 3 times as broad as long, its surface smooth and bearing 3 bristles set in deep pits on either side of meson; labrum twice as broad as long; left mandible with 2 blunt, subequal teeth, right mandible with 3 subacute teeth, middle one smaller than others; frontal carinae absent; malar ridge terminating at compound eye; diameter of posterior ocellus twice as great as length of ocellocular line.

Median two-thirds of anterior margin of pronotum ecarinate; lateral face of pronotum with minute, flattened shagreening dorsally, a single oblique, shallow, cross furrow present near ventral margin; interstices of thoracic dorsum reticulated, this sculpturing sometimes obscure at apex of scutellum; fore wing faintly stained with brown along paths of obsolete veins, marginal vein twice as long as postmarginal, stigmal half as long as postmarginal; scutellum convex in lateral aspect, apical flange with a minute, median emargination; lateral sector of scutellar frenum smooth anteriorly, 5–6 vertical rugae present posteriorly; hind coxa with a median tooth; outer surface of hind femur smooth, shining, pubescence sparse but more dense than in *robusta*, outer ventral tooth more than 3 times as large as any other tooth, 9–11 teeth present, inner tooth absent or faint.

Dorsal surface of first gastral tergum smooth, second tergum faintly sculptured, almost smooth, asetose in broad median area; sixth tergum with dense, vaguely defined, setigerous punctures; apex of gaster subtruncate.

Male.—Length 3.5–5.0 mm. Color as in female, pubescence slightly less dense; basal tooth of hind femur smaller than in female; gaster subtruncate at apex.

Type locality.—Cuba.

Types.—Academy of Natural Sciences of Philadelphia, no. 1824, ♀.

Distribution.—Central and southern Florida; West Indies, British Guiana, Brazil.

Host relationships.—This species seems to be both a primary and secondary parasite of Lepidoptera. It has been reared as a primary parasite from pupae of *Alabama argillacea* (Hbn.), *Ascia monuste* (L.), *Brassolis sophorae* (L.), *Calpodes ethlius* (Cram.), *Eantis thraso* Hbn., *Lymire albipennis* (H.-S.), *Megalopyge krugii* Dewitz, *Mesocondyla concordialis* Hbn., *M. gastralis* Guénée, *Phoebis sennae* (L.), *Pieris monuste* (L.), and *Sylepta* sp., but there also are unquestionable rearings from *Carcelia flavirostris* (V. d. W.) and other, undetermined tachinids that parasitize Lepidoptera.

Brachymeria (Brachymeria) robusta (Cresson)
(Plate XIII, fig. 13; Plate XIV, fig. 21)

Chalcis robusta Cresson.* 1865. Proc. Ent. Soc. Philadelphia, 4: 101; Cresson, 1872. Trans. Amer. Ent. Soc., 4: 59; Howard, 1885. Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 36; Hubbard, 1885, U. S. House of Rep., 48th Cong., 2nd Ses., Misc. Doc. 40, p. 139; Cresson, 1887. Trans. Amer. Ent. Soc., Supp. vol., p. 234; Howard, *in* Scudder 1889. Butterflies of U. S., p. 1887; Dalla Torre, 1898. Cat. Hym., v. 5, p. 392; Schmiedeknecht, 1909. Gen. Ins., fasc. 97, p. 28; Crawford.* 1910. Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 15; Gowdey, 1921. Ann. Rpt. 1920, Jamaica Dept. Agr., p. 25; Gowdey, 1921. Cir. 4, Jamaica Dept. Agr., p. 4; Wilson, 1923. Bul. 3, Virgin Isl. Agr. Expt. Sta., p. 3, 5, 16; Gowdey, 1923. Ent. Cir. 9, Jamaica Dept. Agr., p. 2; Holloway, 1929. Bul. 5, Third Conf., Int. Sugar Cane Tech., p. 19; Myers, 1931. Empire Mkt. Bd. Pubs. 42, p. 118; Winburn and Painter, 1932, Jour. Kansas Ent. Soc., 5: 7; Wolcott.* 1936. Jour. Agr. Univ. P. R., 20: 440; James, 1952. Bul. 50, Jamaica Dept. Agr., n. s., p. 34.

Brachymeria robusta (Cresson) Luginbill, 1928. Tech. Bul. 34, U. S. Dept. Agr., p. 74; Bratley, 1929. Fla. Ent., 13: 44; Wolcott,* 1936. Jour. Agr. Univ. P. R., 20: 536; Peck, *in* Muesebeck *et al.*, 1951. Monog. 2, U. S. Dept. Agr., p. 587; Genung, 1958. Fla. Ent., 41: 191; Genung, 1959. Fla. Ent., 42: 40.

Chalcis robustella Wolcott, 1924. Jour. Dept. Agr. P. R., 7: 56; Ruhl, 1927,

——— Soc. Ent., 42: 40; Wolcott, 1936, Jour. Agr. Univ. P. R., 20: 505. New synonymy.

Brachymeria robustella (Wolcott) Russo, 1927, Mem. 2, Dom. Rep. Dept. Agr., p. 60; Wolcott, 1936, Jour. Agr. Univ. P. R., 20: 536; Wolcott, 1948, Jour. Agr. Univ. P. R., 32: 805; Weber, 1952, Proc. Hawaii. Ent. Soc. 15: 128.

Female.—Length 5.5–9.0 mm. Black, with tegulae, usually fore and mid femora, all but central spot on hind femur, and all tibiae yellow; in darkest specimens fore and mid femora may be black basally and the yellow area of hind femur reduced to small basal and apical spots, or, in lightest specimens, central black spot of hind femur may be greatly reduced, almost absent. Pubescence golden in all specimens.

Antennae inserted slightly dorsal to level of ventral margins of compound eyes; scrobe cavity reaching anterior ocellus, ventral $\frac{2}{3}$ of lateral scrobe margins carinate, ventral scrobe carina deflected dorsally at meson; scrobe cavity 3 times as wide as parascrobal space; antennal scape slightly exceeding apex of scrobe, pedicel twice as wide as long, first funicle slightly longer than second, second slightly longer than third, the latter as wide as long, following funicles becoming progressively wider and shorter, so that seventh funicle is $1\frac{1}{5}$ times as wide as long, apical 2 funicles $1\frac{1}{5}$ times as long as club; clypeus $3\frac{1}{2}$ times as wide as long, its surface smooth and a row of 8 bristles present near dorsal margin; length of labrum $\frac{2}{3}$ its width; left mandible with 2 teeth, ventral one the larger, right mandible with 3 subequal teeth; frontal carinae absent, malar ridge ending at compound eye; diameter of posterior ocellus twice as great as length of ocellocular line.

Median half of anterior margin of pronotum ecarinate; lateral face of pronotum obscurely and minutely sculptured, a broad, shallow, oblique furrow present near ventral margin; all interstices of thoracic dorsum sculptured, dull; fore wing shaded with brown, the marginal vein twice as long as postmarginal, stigmal $\frac{1}{2}$ as long as postmarginal; scutellum low-convex in lateral aspect, apical flange bidentate; lateral sector of scutellar frenum smooth anteriorly, 2 to 4 vertical rugae present posteriorly; hind coxa without median tooth; outer surface of hind femur smooth, shining, only scattered pubescence present, basal tooth more than 4 times as large as any other teeth, 10–12 teeth present, inner tooth absent.

Dorsal surface of first gastral tergum smooth; second tergum faintly sculptured, anterior row of bristles absent in broad median area; sixth tergum with scattered, poorly defined, setigerous punctures; apex of gaster subacuminate.

Male.—Length 5.0–7.5 mm. Color and pubescence as in female; basal tooth of hind femur slightly smaller than in female; gaster subacuminate at apex.

Type locality.—Cuba.

Type.—Academy of Natural Sciences of Philadelphia, no. 1827, ♀.

Distribution.—Florida; West Indies, Mexico. It was introduced into Hawaii, but did not become established.

Host relationships.—This is a primary parasite of the pupae of Lepidoptera; it has been reared from *Alabama argillacea* (Hbn.), an undetermined arctiid, *Celerio lineata* (Fab.), *Heliothis zea* (Boddie), *Laphygma frugiperda* (J. E. Sm.), *Lymire edwardsi* (Grote), *Megalopyge krugii* Dewitz, *M. opercularis* (A. & S.), *Neonympha* sp., *Oiketicus abbotii* Grote, *Papilio cresphontes* Cram., *Mocis latipes* (Guen.).

Brachymeria (Brachymeria) comitator (Walker), new combination (Plate XIII, fig. 15)

Chalcis comitator Walker, 1862, Trans. Ent. Soc. London, ser. 3, 1: 350; Cameron, 1884, Biol. Cent.-Amer., Ins., Hym., v. 1, p. 99; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 26.

Female.—Length 5.5–8.0 mm. Black, with tegulae, apices of femora, bases and apices of tibiae, and tarsi yellow; in some specimens tibiae almost entirely yellow; mandibular teeth, apex of antennal club, and trochanters dark brown. Pubescence of frontovertex and occiput of head and on dorsum of thorax golden, that on face, pleura, venter, legs and gaster silvery.

Antennae inserted slightly dorsal to level of ventral margins of compound eyes; scrobe cavity reaching anterior ocellus, ventral ¾ of lateral scrobe margins carinate, ventral scrobe carina deflected dorsally on meson; scrobe cavity 4 times as wide as parascrobal space; apex of scape slightly exceeding apex of scrobe cavity, pedicel 1½ times as broad as long, first funicle 1½ times as long as broad, second 1¼ times as long as broad, third as long as broad, following funicles becoming progressively shorter, seventh 1⅓ times as broad as long, club ⅔ as long as apical 2 funicles; clypeus 4 times as broad as long, its surface with minute, transverse striae, a row of 6–8 bristles present near dorsal margin; labrum twice as broad as long; left mandible with 2 subequal, blunt teeth, right mandible with 3 subequal, acute teeth; frontal carinae absent; malar ridge ending at compound eye; ocellocular line ⅗ as long as diameter of posterior ocellus.

Median half of anterior margin of pronotum ecarinate, a transverse carina on median half of posterior margin; lateral face of pronotum, (Plate XIII, fig. 15) with dorsal margin complete, dorsal area minutely sculptured, a broad and shallow, oblique furrow present near ventral margin, 2 or 3 vague cross-rugae usually present in furrow; interstices of dorsal area of pronotum and mesoscutum sculptured, this sculpturing present on basal area of scutellum, absent at its apex; fore wing with faint brown staining along paths of obsolete veins, marginal vein 2½ times as long as postmarginal, stigmal ½ as long as postmarginal; scutellum convex in lateral aspect, apical flange with a minute, median notch; lateral sector of scutellar frenum smooth anteriorly, posteriorly with 4–6 short, vertical rugae; hind coxa with a median tooth; outer surface of hind femur densely pubescent,

shining, basal tooth slightly larger than the largest following tooth, 10–12 teeth present; inner tooth wanting, but a vague, toothlike elevation present at middle of inner margin.

First gastral tergum smooth; second tergum with a medianly interrupted, irregular cross-row of bristles at anterior margin, area posterior to this sculptured; sixth tergum bearing closely set, poorly defined, setigerous punctures; apex of gaster subacuminate.

Male.—Length 4.5–6.0 mm. Ventral side of antennal funicle tan and with a densely setose sensory area; color and pubescence otherwise as in female; apex of gaster subtruncate.

Type locality.—Orizaba, Mexico.

Type.—British Museum (Natural History), no. 452, ♀.

Distribution.—South Texas (Harlingen, Raymondsville); Mexico south through Central America to Colombia and Brazil. The two records from Texas may be based on adventive specimens.

Host relationships.—*B. comitator* most likely is a primary parasite of Lepidoptera. It often is taken at U. S. ports of entry in debris from bananas originating in Central America. Specimens have been reared both in quarantine here and in Central American countries from *Ceramidia butleri* (Möschler), *C. viridis* (Druce), and *C.* sp. pupae on bananas. Other specimens have been reared in Colombia from the pupae of *Alabama argillacea* (Hbn.) on cotton, and in Brazil from *Pieris* sp.

Brachymeria (Brachymeria) ovata (Say)
(Plate XIII, figs. 16, 19; Plate XIV, fig. 22)

Chalcis ovata Say,* *in* Keating 1824, Narr. Long's 2nd Exped., App., p. 326; Leconte, 1859, Compl. Writ. Thomas Say, v. 1, p. 219; Cresson,* 1872, Trans. Amer. Ent. Soc., 4: 59; Riley, 1879, Canad. Ent., 11: 161; Lintner, 1882, Ins. N. Y., p. 86; Cameron, 1884, Biol. Cent.-Amer., Ins., Hym., v. 1, p. 99; Howard, 1885, Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 36; Ashmead, 1886, Canad. Ent., 18: 97; Provancher, 1887, Addit. Corr. faune ent. Canad., Hym., p. 190; Howard, *in* Scudder 1889, Butterflies of E. U. S., p. 1886; Howard, 1897, Tech. Ser. 5, U. S. Dept. Agr., Div. Ent., p. 25; Howard, 1897, Bul. 9, U. S. Dept. Agr., Div. Ent., n. s., p. 17; Dalla Torre, 1898, Cat. Hym., v. 5, p. 390; Dimmock, 1898, Proc. Ent. Soc. Washington, 4: 149; Viereck, 1903, Trans. Amer. Ent. Soc., 29: 74; Burke, 1906, Proc. Ent. Soc. Washington, 8: 143; Viereck, 1906, Trans. Amer. Ent. Soc., 32: 184, 227, 245; Swenk, 1908, Cir. 6, Neb. Ins. Pest Bur., p. 4; Crawford,* 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 15; Ainslie, 1910, Bul. 85, U. S. Dept. Agr., Bur. Ent., p. 88;

McDermott, 1911, Proc. Ent. Soc. Washington, 13: 91; Smith, 1911, Bul. 214, N. Car. Agr. Expt. Sta., p. 121; Wildermuth, 1911, Cir. 133, U. S. Dept. Agr., Bur. Ent., p. 8, 14; Hunter, 1912, Proc. Ent. Soc. Washington, 14: 63; Haseman, 1912, Bul. 104, Mo. Agr. Expt. Sta., p. 324; Wildermuth, 1914, Bul. 124, U. S. Dept. Agr., p. 21; Snodgrass, 1917, Ann. Rpt. 9, Indiana State Ent., p. 180, 188; Ainslie and Cartwright, 1922, Bul. 1076, U. S. Dept. Agr., p. 12; Fracker, 1922, Bul. 52, Wisc. Agr. Expt. Sta., p. 39; Horton, 1922, Mon. Bul., Calif. State Dept. Agr., 11: 385; Baerg, 1928, Bul. 224, Ark. Agr. Expt. Sta., p. 8; Winburn and Painter, 1932, Jour. Kansas Ent. Soc., 5: 7; Wildermuth and Frankenfeld, 1933, Jour. Econ. Ent., 26: 797; Balduf, 1937, Proc. Ent. Soc. Washington, 39: 180.

Brachymeria ovata (Say) Poos, 1928, Proc. Ent. Soc. Washington, 30: 146; Douglas, 1930, Jour. Econ. Ent., 23: 689; Chamberlain, 1931, Jour. Econ. Ent., 24: 1040; Nettles, 1934, Jour. Econ. Ent., 27: 816; Schaffner and Griswold, 1934, Misc. Pub. 188, U. S. Dept. Agr., p. 152; Dowden,* 1935, Jour. Agr. Res., 50: 496; Houser, 1935, Ann. Ent. Soc. Amer. 28: 106; McKenzie, 1935, Bul. 592, Calif. Agr. Expt. Sta., p. 21; Creighton, 1936, Jour. Econ. Ent., 29: 93; Burks,* 1936, Trans. Ill. Acad. Sci., 29: 253; Donahoe and Kaloostian, 1937, Jour. Econ. Ent., 30: 967; Summerland, 1938, Trans. Kans. Acad. Sci., 40: 163; Knowlton and Harmston, 1939, Proc. Utah Acad. Sci., Arts, and Letters, 16: 62; Snodgrass, 1941, Smithsn. Misc. Coll., 99: 36; Smith, 1943, Rpt. 62, Kans. State Bd. Agr., p. 392; Schuh and Mote, 1948, Tech. Bul. 13, Oreg. Agr. Expt. Sta., p. 25; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587; Walley, 1953, Canad. Ent., 85: 152; Harville, 1955, Microent., 20: 115; Drooz and Benjamin, 1956, Jour. Econ. Ent., 49: 413; Genung, 1958, Fla. Ent., 41: 191; Genung, 1959, Fla. Ent., 42: 40.

Chalcis ovata var. *abiesae* Girault, 1917, Descr. Stell. Nov., p. 19; Rohwer, 1918, Proc. Ent. Soc. Washington, 20: 18. New synonymy.

Chalcis abiesae Girault, Burke and Herbert, 1920, F. Bul. 1076, U. S. Dept. Agr., p. 10.

Brachymeria ovata abiesae (Girault) Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587.

Female.—Length 3.5–6.5 mm. Black, with tegulae, apices of femora, usually entire fore and mid tibiae, base and apex of hind tibia, and all tarsi creamy white to yellow; sometimes there is a median black spot on inner surface of fore and mid tibia, and median black area of hind tibia may be greatly reduced; apices of mandibles, antennal radicle, and antennal club dark brown. Pubescence silvery.

Antennae inserted slightly above level of ventral margins of compound eyes; apex of scrobe cavity reaching anterior ocellus, ventral ⅔ of lateral scrobe margins carinate, ventral scrobe carina deflected dorsally on meson; scrobe cavity 4 times as wide as parascrobal space; apex of antennal scape slightly exceeding apex of scrobe cavity, pedicel 1½ times as broad as long, first funicle ⅚ as long as broad, second funicle slightly longer than wide,

third as long as wide, seventh 1½ times as wide as long, club ⅗ as long as apical 2 funicles; clypeus 4 times as wide as long, surface of ventral half with minute, faint cross-striae, dorsal half depressed, bearing 6–8 irregularly spaced setae; labrum 3 times as wide as long; left mandible with 2 blunt, subequal teeth, right mandible with 3 subequal teeth, ventral one more acutely pointed than others; frontal carinae absent, malar ridge terminating at compound eye, but cheek usually with a short, irregular carina extending forward a short distance from lateral margin (Plate XIII, fig. 16); length of ocellocular line ⅗ as great as diameter of lateral ocellus.

Median third of anterior margin of pronotum ecarinate, a transverse carina usually present in median half of posterior margin, in some specimens this carina so irregular as scarcely to be distinguishable; dorsal margin of lateral face of pronotum interrupted anteriorly (Plate XIII, fig. 19), dorsal area closely shagreened, an oblique, broad and shallow cross-furrow present ventrally, usually 1 ruga crossing this furrow; interstices of thoracic dorsum sculptured, dull, this sculpture becoming faint at apex of scutellum; fore wing hyaline, marginal vein from 2 to 2⅓ times as long as postmarginal, stigmal from ⅓ to ½ as long as postmarginal; scutellum convex in lateral aspect, apical flange entire; lateral sector of scutellar frenum anteriorly faintly sculptured, almost smooth, and 4–6 vertical rugae extending a short way dorsally from ventral margin; hind coxa with a median tooth; outer surface of hind femur densely setose, shining; outer basal tooth slightly longer than the largest following teeth, 9–12 teeth present, inner tooth absent.

Dorsal surface of first gastral tergum smooth; second tergum with an irregular cross-row of bristles at anterior margin, this row often interrupted on meson, median area of tergum posterior to this row closely sculptured; sixth tergum with closely set, anastomosing, setigerous punctures; gaster subtruncate at apex.

Male.—Length 3.5–5.0 mm. Ventral sensory area of antennal funicle densely setose and tan, color otherwise as in female; pubescence of front, fronto-vertex, occiput, and on thoracic dorsum almost always golden, elsewhere silvery, but occasional male specimens have all pubescence silvery; apex of gaster truncate.

Type localities.—Ohio and Pennsylvania.

Types.—Lost. The identity of this species was fixed by the recharacterization of Cresson in 1872. Cresson's material is preserved in the Academy of Natural Sciences of Philadelphia.

Distribution.—Throughout the United States except for northern New England, North Dakota, and Montana. Known only from Ontario in Canada. Occurs also in Northern Mexico. Neotropical specimens that I have seen that had been identified as *B. ovata* are not the same, although the differences may be only subspecific. The Nearctic specimens do not show subspecific differences.

Host relationships.—*B. ovata* is a primary parasite of the pupae of moths and butterflies. The hosts are distributed through 18 families of the Lepidoptera, from the Psychidae in the Microlepidoptera to the Papilionidae in the Macrolepidoptera. Nearly 100 species have been recorded as hosts of *ovata*, but some of these may be wrong. It seems clear, however, that almost any lepidopterous pupa that is sufficiently large and adequately exposed will serve. No specimens of *ovata* have been reared from the smallest of the moths, and the relatively short ovipositor that *ovata* has would prevent it from ovipositing in pupae lying beneath a thick protective covering.

As Dowden [23] found to be true for *B. intermedia*, the larva of *ovata* does not consume all the body contents of its host. Many lepidopterous pupae from which adult *ovata* has emerged still contain half or more of the uneaten host body tissues. Only one *ovata* adult emerges from a host pupa. I have observed *ovata* ovipositing in the freshly formed pupae of the tussock moth. It spends an inordinately long time examining the host from all angles before accepting it for oviposition.

Subgenus **GAHANULA** new subgenus

Description.—Antennae inserted at level of ventral margins of compound eyes; apex of antennal scape reaching anterior ocellus; scrobe cavity relatively narrow, parascrobal space broad, lateral margins of scrobe cavity carinate ventrally, ecarinate dorsally; left mandible with 2 teeth, right mandible with 3; frontovertex carinate or with vague and poorly defined carinae. Prepectus minute, peglike, much smaller than tegula; wings hyaline; scutellum with a prominently projecting, median elevation (Plate XIII, fig. 18); hind coxa lacking a median tooth; hind femur with basal tooth as large as largest of the following teeth, inner femoral tooth vague, but discernible. Gaster acuminate; posterior margins of terga 2 and 3 broadly emarginate on meson; tergum 7 with a median, longitudinal carina.

Type species.—*Brachymeria discreta* Gahan.

Key to Species

1. Frontal carinae always well developed; ocellocular line ⅖ as long as diameter of lateral ocellus; marginal vein 4 times as long as postmarginal; propodeum with elongate, median areola
discretoidea Gahan

[23] Jour. Agr. Res., 50: 508, 1935.

Frontal carinae weak, virtually absent; ocellocular line ⅗ as long as diameter of lateral ocellus; marginal vein 3½ times as long as postmarginal; propodeum lacking elongate, median areola *discreta* Gahan

Brachymeria (Gahanula) discreta Gahan (Plate XIII, fig. 18)

Brachymeria discreta Gahan, 1942, Proc. U. S. Natl. Mus., 92: 43; Weber, 1951, Proc. Hawaii. Ent. Soc., 14: 223; Burks, *in* Krombein *et al.* 1958, Monog. 2, Supp., U. S. Dept. Agr., p. 83.

Female.—Length 4.0–5.0 mm. Head, body, and fore coxae black; tegulae, apices of femora, bases and apices of tibiae and tarsi yellow; antennal scape and pedicel and all darker parts of legs (except fore coxae) tan to light brown; apices of mandibles, antennal flagellum, and usually venter of gaster at base dark red-brown. Pubescence of thoracic notum golden, elsewhere silvery.

Ventral margin and ventral ⅔ of lateral margins of scrobe cavity carinate, scrobe cavity 2½ times as wide as parascrobal space; usually a carina on face extending a short way laterally from ventrolateral angle of scrobe margin; apex of antennal scape reaching anterior ocellus, pedicel and first funicle segment each 1½ times as long as wide, second funicle 1¼ times as long as wide, third and following funicles as long as wide, club as long as apical 2 funicles; clypeus 3 times as wide as long, 6–8 bristles borne near dorsal margin; labrum twice as wide as long; left mandible with ventral tooth large, dorsal one minute, right mandible with ventral tooth large, middle one minute, dorsal one approximately half as large as ventral one; malar ridge deflected backward beneath compound eye and extending to lateral margin of cheek; frontal carinae present, but faint in some specimens, a vague carina crossing vertex behind median ocellus; ocellocular line ⅗ as long as diameter of lateral ocellus.

Median ⅗ of anterior margin of pronotum ecarinate, carina absent at posterior margin; interstices of thoracic notum sculptured and dull anteriorly, becoming smooth and shining at apex at praescutum and on scutellum; fore wing with marginal vein 3½ times as long as postmarginal and 5 times as long as stigmal; lateral sector of scutellar frenum shagreened anteriorly and with 5 or 6 short rugae extending vertically from ventral margin posteriorly; outer surface of hind femur densely pubescent, sculptured, subshining, outer ventral basal tooth the same size as largest of the following teeth, 10–12 teeth present, inner tooth vague, but visible.

Propodeum without elongate, median areola; gaster short-acuminate; first gastral tergum shining, following ones faintly sculptured, subshining; posterior margins of terga 2 and 3 broadly emarginate on meson; tergum 6 with closely set, poorly defined setigerous punctures; seventh tergum as long as sixth, a sharp, longitudinal carina present on dorsal meson of tergum 7.

Male.—Length 3.5 mm. Color and pubescence as in female; scrobe cavity 3 times as wide as parascrobal space; gaster subtruncate at apex.

Type locality.—Tamazunchale, San Luis Potosi, Mexico.

Types.—U.S.N.M. no. 55149, ♀, ♂.

Distribution.—Texas, Arizona, Southern California; Hawaii; Mexico.

Host relationships.—This species has been reared from the nest of *Polistes instabilis* Sauss., as well as from a species of *Tinea* breeding in chicken droppings. The specimens from the wasp nest probably emerged from one of the pyraustid moths which sometimes infest these nests.

Brachymeria (Gahanula) discretoidea Gahan

Brachymeria discretoidea Gahan, 1942, Proc. U. S. Natl. Mus. 92: 44; Burks, *in* Krombein *et al.* 1958, Monog. 2, Supp., U. S. Dept. Agr., p. 83.

When first described, this species was considered to be very similar to *discreta*, but seemingly sufficiently distinct to justify being described as a different species. Specimens that have been secured subsequently have been difficult to assign without question to *discreta* or *discretoidea*. The indicated differences between the two have tended to intergrade. A complete intergradation between them has not yet been found, however, so they may for the present be maintained as distinct species.

B. discretoidea differs from *discreta* only as indicated in the key above. Otherwise the two agree in color and structure.

Type locality.—Frijoles, Panama.

Types.—U.S.N.M. no. 55150, ♀, ♂.

Distribution.—Texas, Arizona; Mexico, Panama.

Host relationships.—Reared from a nest of *Trigona amalthea* (Oliv.) infested by an unidentified moth.

Subgenus **PSEUDOBRACHYMERIA** new subgenus

Pseudochalcis Ashmead, 1904, Mem. Carnegie Mus. 1: 249, 250; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 19, 23 [misdetermined; not *Pseudochalcis* of Kirby, a synonym of *Stypiura* Kirby in the Haltichellinae].

Description.—Antennae inserted at or slightly below level of ventral margins of compound eyes; apex of antennal scape not quite reaching ventral margin of anterior ocellus; scrobe cavity broad, parascrobal space narrow, margins of scrobe cavity usually completely carinate; left mandible with 2 teeth, right mandible with 3; a carina extending across vertex just posterior to median ocellus and anterior to lateral ocelli, this carina usually

curving down on either side of frons and extending to or beyond dorsolateral angles of scrobe margins (Plate XII, figs. 3, 7). Prepectus a narrow straplike sclerite which is much smaller than tegula; wings hyaline, except for shading around stigma in *columbiana;* hind coxa lacking a median tooth; hind femur with basal tooth small, following teeth relatively few and widely spaced, inner femoral tooth wanting or poorly developed. Gaster usually elongate-acuminate, sometimes subtruncate; posterior margin of tergum 2 broadly emarginate on meson, posterior margins of terga 3 or 3 and 4 also sometimes emarginate on meson; tergum 7 usually with a sharp, longitudinal, median carina.

Type species.—Pseudochalcis conica Ashmead.

Key to Species

1. Frontal carinae long, extending from vertex to level of ventral margins of compound eyes (Plate XII, fig. 3); scutellum sometimes red; gaster black with ventrobasal area red-brown; minimum width of parascrobal space half as great as width of anterior ocellus *pedalis* (Cresson)

   Frontal carinae absent or shorter, when present not extending much below dorsolateral angles of scrobe cavity (Plate XII, fig. 7) 2

2. Hind legs and gaster mostly brown-red ..... *columbiana* (Howard)

   Hind legs almost entirely black or chocolate brown, gaster black or chocolate brown 3

3. Fore and mid tibiae entirely yellow, hind tibia yellow with a narrow black ring at base; apex of scutellum with a pair of upturned teeth; seventh gastral tergum 1½ to 2 times as long on meson as sixth; minimum width of parascrobal space ⅔ as great as diameter of anterior ocellus ..... *psyche* new species

   At least hind tibia with extensive black or chocolate brown shading in the middle, usually all tibiae with some dark shading 4

4. Outer surface of hind femur shining, pubescence relatively sparse; dark parts of hind leg usually chocolate brown ..... *laetiliae* new species

   Outer surface of hind femur dull and mat, pubescence relatively dense; hind leg with dark parts always black 5

5. Gaster elongate, seventh tergum longer than sixth; on face a short carina extends transversely laterally from each ventrolateral angle of scrobe cavity to, or nearly to, margin of compound eye *conica* (Ashmead)

   Gaster compact, seventh tergum half as long as sixth and bilaterally compressed; face without transverse carinae extending from scrobe cavity toward compound eyes, either faint, irregular, oblique carinae present, or facial carinae entirely absent ..... *flegiae* new species

Brachymeria (Pseudobrachymeria) pedalis (Cresson) (Plate XII, fig. 3)

Chalcis pedalis Cresson,* 1872, Trans. Amer. Ent. Soc., 4: 60; Howard,

1885, Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 36; Cresson, 1887, Trans. Amer. Ent. Soc., Supp. vol., p. 234; Dalla Torre, 1898, Cat. Hym., v. 5, p. 391; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 27; Crawford,* 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 14.

Brachymeria pedalis (Cresson) Hamlin, 1925, Pan-Pac. Ent., 2: 4; Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587.

Female.—Length 5.0–6.0 mm. Head black, thorax usually entirely black, sometimes with dorsum partly red, gaster black with ventrobasal area dark red-brown; mid coxae sometimes red-brown, hind coxae and all trochanters always red-brown; femora red-brown, apices yellow, tibiae red-brown, bases and apices yellow, tarsi tan; apices of mandibles and bases of antennal scapes red-brown, tegulae yellow. Pubescence silvery.

Lateral margins of scrobe cavity ecarinate in upper one-fourth, elsewhere strongly carinate, scrobe cavity 4 times as wide as parascrobal space; apex of antennal scape not reaching anterior ocellus; pedicel 1½ times as wide as long, first 5 funicles 1¼ times as wide as long, sixth and seventh funicles 1½ times as wide as long, club slightly longer than funicles 6 and 7; clypeus 3 times as wide as long, bearing 10–12 bristles, surface flat, smooth, and shining; labrum 2½ times as wide as long, surface faintly sculptured, a tuft of long bristles borne at apex; left mandible with 2 teeth subequal in size, dorsal one more blunt than ventral one, right mandible with acute ventral tooth, small middle tooth, and a blunt dorsal one subequal in size to ventral tooth; malar ridge deflected backward beneath compound eye, not quite extending to lateral margin of cheek; carina crossing vertex and extending down frons on either side to level of ventral margins of compound eyes; ocellocular line as long as diameter of lateral ocellus.

Median ⅔ of anterior margin of pronotum ecarinate, a carina lying close to and paralleling median half of posterior margin; interstices of dorsum of pronotum, praescutum and scutum sculptured and dull, those of scutellum smooth and shining; fore wing with marginal vein 2½ times as long as postmarginal and 5 times as long as stigmal; scutellum convex in lateral aspect, apical flange narrow, entire; lateral sector of scutellar frenum shagreened and with 5–8 short rugae extending upward from ventral margin posteriorly; outer surface of hind femur densely setose, shining, basal tooth slightly smaller than the largest of the following teeth, 10–12 teeth present, inner tooth wanting.

Gaster short-acuminate, terga 1–5 shining, but with faint sculpture posteriorly on terga 2–5; posterior margin of tergum 2 broadly emarginate on meson; tergum 6 with closely set, well-defined, setigerous punctures; tergum 7 densely setose, its dorsal length half that of tergum 6, median, longitudinal carina of tergum 7 wanting.

Male.—Length 5.0–5.5 mm. Color much as in female, but usually hind coxae partly or entirely black and hind femora sometimes basally black; gaster usually entirely black, subtruncate at apex.

Type locality.—Texas.

Type.—U.S.N.M. no. 1660, ♀.

Distribution.—Texas, Colorado, New Mexico, Arizona, California.

Host relationships.—*B. pedalis* has been reared as a primary parasite from the following Lepidoptera: *Noctuelia elautalis* (Grote), *Melitara prodenialis* Walk., *M. dentata* Grote, and *M.* sp., and *Ozamia clarefacta* Dyar. All but the first of these moths feed on cactus.

Brachymeria cactoblastidis Blanchard,[24] from Brazil and Argentina, seems to be the same as *pedalis,* but I have not seen the type of *cactoblastidis.*

Brachymeria (Pseudobrachymeria) columbiana (Howard)

Chalcis columbiana Howard,* 1885, Bul. 5, U. S. Dept. Agr., Bur. Ent., p. 8, 36; Cresson, 1887, Trans. Amer. Ent. Soc., Supp. vol., p. 234; Dalla Torre, 1898, Cat. Hym., v. 5, p. 387; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 26; Crawford,* 1910, Tech. Ser. 19, U. S. Dept. Agr., Bur. Ent., p. 15.

Brachymeria columbiana (Howard) Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 586; Burks, *in* Krombein *et al.* 1958, Monog. 2, Supp., U. S. Dept. Agr., p. 83.

Chalcis louisiana Girault, 1917, Descr. Stell. Nov., p. 6. New synonymy.

Brachymeria louisianae (Girault) Peck, *in* Muesebeck *et al.* 1951, Monog. 2, U. S. Dept. Agr., p. 587.

Female.—Length 4.5–6.0 mm. Head, thorax, and apex of gaster black; antennal scapes, dark parts of legs, propodeum, and basal ⅔ of gaster brown-red; tegulae, apices of femora, bases and apices of tibiae, and tarsi yellow. Pubescence silvery.

Margins of scrobe cavity completely carinate, scrobe cavity 5½ times as wide as parascrobal space; apex of antennal scape not quite reaching anterior ocellus, pedicel as long as wide, first funicle as long as wide, second slightly wider than long, seventh 1⅖ times as wide as long, club slightly longer than apical 2 funicles; clypeus 3 times as wide as long, its surface smooth and with 4 bristles near dorsal margin; labrum 1½ times as wide as long, its surface faintly sculptured; malar ridge deflected backward beneath compound eye and extending to lateral margin of cheek; left mandible with 2 acute teeth, ventral one the larger, right mandible with 3 acute teeth, ventral one large, middle one minute, dorsal tooth half as large as ventral one; carina crossing vertex and curving down on either side, becoming obsolete before reaching scrobe margins; ocellocular line ⅔ as long as diameter of lateral ocellus.

Median half of anterior margin of pronotum ecarinate; interstices of thoracic dorsum sculptured and dull, becoming smooth and shining at apex.

[24] Rev. Soc. Ent. Argentina, 7: 103, 1935.

of scutellum; fore wing with marginal vein 2½ times as long as postmarginal and 5 times as long as stigmal, a small, faint, brownish cloud around stigmal vein; scutellum convex in lateral aspect, apical flange with a minute, median indentation; lateral sector of scutellar frenum shagreened, 2 or 3 short rugae extending upward from ventral margin posteriorly; outer surface of hind femur sparsely setose, smooth and shining, basal tooth minute, 6 or 7 widely spaced teeth present, inner tooth minute, but discernible.

Gaster acuminate, first tergum smooth, shining, terga 2–5 subshining, lightly sculptured; posterior margins of terga 2 and 3 broadly emarginate on meson; tergum 6 with numerous, poorly defined, setigerous punctures, tergum 7 densely setose, a sharp, longitudinal, median carina present in basal half; terga 6 and 7 equal in length on meson.

Male.—Length 4.5–5.0 mm. Color in most specimens as in female, but in some the antennal scapes, most of the fore and mid legs, and the propodeum are black; gaster subtruncate at apex.

Type locality.—District of Columbia.

Type.—U.S.N.M. no. 2625, ♀.

Distribution.—District of Columbia, Virginia, Florida, Louisiana.

Host relationships.—Specimens of this species are said to have been reared from *Pseudococcus citri* (Risso), *Kermes galliformis* Riley, and an undetermined coccid on tulip tree. It is unlikely, however, that an insect as large as this one emerged directly from those coccids. It is probable that *columbiana* is a parasite of the larvae of the moth *Laetilia coccidivora* Comstock, which prey on coccids.

Brachymeria (Pseudobrachymeria) psyche new species

This species resembles *conica* (Ashmead) in having the margins of the scrobe cavity completely carinate, in having the carina of the frontovertex extending down to the dorsolateral angles of the scrobe margins, and in having the median dorsal length of the seventh gastral tergum greater than that of the sixth tergum; they differ in that *psyche* has all the tibiae yellow and the apical toothlike projections of the scutellum are upturned.

Female.—Length 6.0–8.5 mm. Black, with tegulae, fore and mid legs distal to the bases of the femora, apex of hind femur, hind tibia, except for narrow ring at base, and hind tarsus, yellow. Pubescence silvery.

Margins of scrobe cavity completely carinate, scrobe cavity 6 times as

wide as parascrobal space; a short, vague carina extends laterally on face from each ventrolateral angle of scrobe cavity; apex of antennal scape not reaching anterior ocellus, pedicel as wide as long, first funicle longer than wide, second as long as wide, third wider than long, seventh funicle 1½ times as wide as long, club as long as apical 2 funicles; clypeus twice as wide as long, a cross-row of 8–10 bristles located near dorsal margin, surface sculptured near lateral margins, smooth medially; labrum 2½ times as wide as long, its surface minutely sculptured; malar ridge deflected backward beneath compound eye, extending toward lateral margin of cheek, but becoming obsolete before reaching it; carina crossing vertex and extending ventrally on frons for a distance half as great as its length on vertex; ocellocular line half as long as diameter of lateral ocellus.

Median ⅗ of anterior margin of pronotum ecarinate; interstices of thoracic dorsum sculptured and dull, becoming shining and smooth at apex of scutellum; fore wing with marginal vein 3 times as long as postmarginal and 4 times as long as stigmal; scutellum almost flat in lateral aspect, apical flange deeply notched on meson, upturned; lateral sector of scutellar frenum shagreened anteriorly, with 3 or 4 vertical rugae posteriorly; outer surface of hind femur with closely set, fine pubescence, surface faintly sculptured, but shining, basal tooth blunt, shorter than any following teeth, 8–10 teeth present; inner femoral tooth faint, virtually absent.

Gaster elongate-acuminate; first tergum smooth, shining, second tergum faintly sculptured, following terga more intensely so; posterior margins of terga 2–4 broadly emarginate on meson; tergum 6 with numerous, poorly defined, setigerous punctures; seventh tergum 1½ to 2 times as long as sixth on meson, a sharp, longitudinal, median carina on tergum 7.

Male.—Unknown.

Type locality.—Dade County, Florida.

Type.—Female. Dade County, Florida, June 1936, in McPhail trap, O. D. Link [U.S.N.M. no. 65106].

Paratypes.—FLORIDA: 1 ♀, Charlotte Harbor, Mrs. Slosson; 1 ♀, Lake Worth, reared from *Oiketicus abbotii* Grote, Mrs. Slosson [USNM].

Host relationships.—Possibly *psyche* is a primary parasite of psychid moths.

Brachymeria (Pseudobrachymeria) laetiliae new species

This species agrees with *conica* (Ashmead) in having the tibiae partly dark, the scrobe cavity margins completely carinate, and in having the gaster acuminate; *laetiliae* differs in that the outer surface of the hind femur is shining and sparsely pubescent, rather than dull and densely pubescent, the antennal club is proportionately longer, and gastral terga 6 and 7 are equal in length.

Female.—Length 5.0–6.5 mm. Head and thorax black, propodeum and gaster and darkened parts of legs usually chocolate brown, occasionally black; tegulae, apices of femora, bases and apices of tibiae, and tarsi yellow; mandibles and antennae usually brown, sometimes black. Pubescence silvery.

Margins of scrobe cavity completely carinate, scrobe cavity 5 times as wide as parascrobal space; usually an irregular carina on face extending from ventrolateral angle of scrobe cavity to malar suture, in some specimens this carina vague or wanting; apex of antennal scape not reaching anterior ocellus, pedicel wider than long, first funicle slightly longer than wide, second and following funicles wider than long, club 1⅓ times as long as apical 2 funicles; clypeus 4 times as wide as long, surface shagreened laterally, faintly striolate medially, ventral half of clypeus depressed, 4–8 bristles borne near dorsal margin; labrum lightly shagreened, twice as wide as long; malar ridge deflected backward beneath compound eye and extending to lateral margin of cheek; carina crossing vertex usually vague, its downward extensions on frons slightly more distinct, but becoming obsolete before reaching scrobe cavity margins; ocellocular line half as long as diameter of lateral ocellus.

Median ⅔ of anterior margin of pronotum ecarinate, an irregular carina paralleling median half of posterior margin; interstices of thoracic notum scultpured and dull, becoming smooth and shining at apex of scutellum; fore wing with marginal vein 3 times as long as postmarginal and 5 times as long as stigmal; scutellum low-convex in lateral aspect, apical flange with a median notch; lateral sector of scutellar fremum shagreened and with 3–5 short rugae extending upward from ventral margin posteriorly; outer surface of hind femur shining and with relatively sparse pubescence, basal tooth poorly developed, smaller than any following teeth, 6–8 widely spaced teeth present, inner tooth faint or absent.

Gaster acuminate; first tergum smooth and shining, following terga sculptured; posterior margins of terga 2 and 3 broadly emarginate on meson, tergum 6 with fairly well defined, setigerous punctures, tergum 7 densely setose, median, longitudinal carina wanting or faint, median lengths of terga 6 and 7 equal.

Male.—Length 4.0 mm. Color and pubescence as in female; scrobe cavity 6 times as wide as parascrobal space; gaster subacuminate at apex.

Type locality.—St. David, Arizona.

Type.—Female. St. David, Arizona, July 8, 1947, reared from *Laetilia coccidivora* (Comstock), L. P. Wehrle [U.S.N.M. no. 65107].

Allotype.—Male. Same data [USNM].

Paratypes.—ARIZONA: 2♀, same data as type; 1♀, 1♂, Globe, Sept. 10, 1917, collected on *Thurberia,* C. H. T. Town-

send; 1 ♀, Prescott N. F., July 14, 1940, D. J. and J. N. Knull. CALIFORNIA: 1 ♀, 1 ♂, Mesa Grande Indian School, Mar. 2, 1897, reared from *Laetilia coccidivora,* Mary C. B. Watkins; 1 ♀, Mt. Hamilton, Apr. 24, 1930, reared from *Laetilia zamacrella* Dyar, Hopk. 19013a, H. E. Burke; 1 ♀, Walnut Creek, Mar. 29, 1954, on *Pinus radiata*, Hopk. 33966b, Ed. Swift; 3 ♀, Walnut Creek, Aug. 21, 1959, reared from *Laetilia zamacrella,* J. Phillips. NEW MEXICO: 2 ♀, Las Cruces, C. F. Baker; 1 ♀, Mesilla Park, Aug. 9, T. D. A. Cockerell. OKLAHOMA: 1 ♀, 867. [All specimens USNM.]

Host relationships.—This species probably is a primary parasite of moths of the genus *Laetilia* in the Southwest.

Brachymeria (Pseudobrachymeria) conica (Ashmead), new combination (Plate XII, fig. 7)

Pseudochalcis conica Ashmead, 1904, Mem. Carnegie Mus. 1: 407; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 23.

Female.—Length 5.0–7.0 mm. Black, with tegulae, apices of femora, bases and apices of tibiae, and tarsi yellow; in some specimens the tegula is black or dark brown anteriorly. Pubescence silvery.

Margins of scrobe cavity completely carinate, scrobe cavity 6 times as wide as parascrobal space; a curved carina extends from ventrolateral angle of scrobe to compound eye; apex of antennal scape not quite reaching anterior ocellus, pedicel longer than wide, first funicle as long as wide, following funicles becoming progressively shorter, so that seventh funicle is 1⅓ times as wide as long, club as long as apical 2 funicles; clypeus 4 times as wide as long, surface with minute, closely set, transverse striae, a cross-row of 6–8 bristles present near dorsal margin; labrum twice as wide as long, its surface minutely shagreened; malar ridge deflected backward beneath compound eye and reaching lateral margin of cheek; carina crossing vertex and extending ventrally on frons for a distance half as great as its length on vertex; ocellocular line half as long as diameter of lateral ocellus.

Median half of anterior margin of pronotum ecarinate, an irregular carina paralleling median half of posterior margin; interstices of thoracic dorsum sculptured, dull; fore wing with marginal vein twice as long as postmarginal, stigmal half as long as postmarginal; scutellum almost flat in lateral aspect, apical flange emarginate on meson; lateral sector of scutellar frenum shagreened anteriorly and with 3 or 4 short, vertical rugae extending upward from ventral margin posteriorly; outer surface of hind femur densely setose, sculptured and dull, basal tooth ½ as large as largest following teeth, 7–9 widely spaced teeth present, inner tooth absent.

Gaster elongate-acuminate; first tergum shining, exposed portions of terga 2 to 5 sculptured, dull; posterior margins of terga 2 and 3 deeply and

broadly emarginate on meson, tergum 6 with closely set, poorly defined, setigerous punctures, tergum 7 densely setose, 1½ times as long as tergum 6, a sharp, longitudinal carina present on dorsal meson of tergum 7.

Male.—Length 4.5–5.0 mm. Color and pubescence as in female; scrobe cavity 10 times as wide as parascrobal space; gaster subacuminate at apex.

Type locality.—Santarem, Brazil.

Types.—U.S.N.M. no. 8061, ♀.

Distribution.—Texas; south through Central America to Brazil; Trinidad, West Indies.

Host relationships.—*B. conica* is occasionally intercepted at U. S. ports of entry in banana debris from Central America. In one instance a specimen emerged from an aculeate pupa in a nest on a banana leaf. Another specimen was reared from the puparium of a sarcophagid fly taken from a bird nest, while another specimen was said to have been reared from the pupa of the phycitid moth *Melitara dentata* (Grote). It is not possible to draw a satisfactory conclusion about the host relationships of *conica* from these scattered host records.

Brachymeria (Pseudobrachymeria) flegiae new species

This species agrees with *conica* (Ashmead) and other members of this subgenus in having a transverse carina on the vertex and in having the posterior margin of gastral tergum 2 broadly emarginate on the meson. *Flegiae* differs from all of them in having the gaster compact rather than elongate and in having tergum 7 bilaterally compressed.

Female.—Length 3.5–4.5 mm. Black, with tegulae, apices of femora, bases and apices of tibiae, and tarsi white to pale yellow; antennae and mandibles dark brown. Pubescence silvery.

Margins of scrobe cavity completely carinate, scrobe cavity 5 times as wide as parascrobal space; usually a short, irregular carina on either side of face extending obliquely laterally from ventrolateral angles of scrobe margins; apex of antennal scape not quite reaching anterior ocellus, pedicel longer than wide, first funicle as long as wide, second and following funicles wider than long, seventh 1⅔ times as wide as long, club slightly longer than apical 2 funicles; clypeus 3 times as wide as long, surface shagreened laterally, faintly striolate medially, ventral half of clypeus depressed, 4–6 bristles borne near dorsal margin; labrum twice as wide as long, surface faintly sculptured; malar ridge deflected backward beneath compound eye and extending to lateral margin of cheek; carina crossing vertex and extending down on either side of frons for a distance ⅓ as great as its length

on vertex; ocellocular line half as long as diameter of lateral ocellus.

Median ⅖ of anterior margin of pronotum ecarinate, an irregular carina paralleling median half of posterior margin; interstices dull, sculptured on pronotum, mesoscutum and praescutum, and base of scutellum, shining and smooth on middle and apical areas of scutellum; fore wing with marginal vein 2½ times as long as postmarginal and 3½ times as long as stigmal; scutellum convex in lateral aspect, apical flange narrow, with a median notch; lateral sector of scutellar frenum shagreened anteriorly, with 3–6 vertical rugae present posteriorly; outer surface of hind femur densely pubescent, dull, basal tooth smaller than longest following tooth, 8–10 teeth present, inner femoral tooth small, blunt.

Gaster short and compact, subtruncate at apex; first tergum smooth and shining, following terga sculptured and dull; posterior margin of tergum 2 broadly emarginate on meson; tergum 6 with numerous, coalescent, setigerous punctures; tergum 7 densely setose, bilaterally compressed, and half as long as tergum 6 on meson.

Male.—Length 3.5–4.0 mm. Color and pubescence as in female; gaster truncate at apex, tergum 6 located slightly farther posteriorly than tergum 7.

Type locality.—Brownsville, Texas.

Type.—Female. Brownsville, Texas, Sept. 28, 1941, reared from *Palpita flegia* (Cram.) [U.S.N.M. no. 65108].

Allotype.—Male. Same data [USNM].

Paratypes.—TEXAS: 17 ♀, 2 ♂, same data as type; 6 ♀, 1 ♂, Brownsville, Apr. 22, 1938, reared from *Palpita flegia;* 11 ♀, 3 ♂, Brownsville, May 30, 1947, reared from *Palpita flegia* on *Thevetia nereifolia,* Pfaffman; 1 ♀, Corpus Christi, Mar. 18, 1908, Jones and Pratt; 1 ♀, Dallas, Sept. 4, at cotton nectary, W. D. Pierce. [All specimens USNM].

Host relationships.—This species seems to be a primary parasite of the moth *Palpita flegia* (Cram.).

Explanation of Figures

Plate XII

Fig. 1.—*Brachymeria.* Head, showing areas and structures used in classification. AO, anterior ocellus; CE, compound eye; Cl, clypeus; FC, frontal carina; FGS, frontogenal suture; IP, interantennal process; Lb, labrum; LMd, left mandible; MR, malar ridge; OOL, ocellocular line; PS, parascrobal space; RMd, right mandible; SC, scrobe cavity.

Fig. 2.—*B. hammari* (Crawford). Anterior aspect of head of ♀.

Fig. 3.—*B. pedalis* (Cresson). Dorsal aspect of head of ♀.

Fig. 4.—*B. mexicana* (Dalla Torre). Dorsal aspect of head and pronotum of ♀. OcC, occipital carina.

Fig. 5.—*B. russelli,* new species. Dorsal aspect of head and pronotum of ♀.

Fig. 6.—*B. compsilurae* (Crawford). Dorsal aspect of head and pronotum of ♀.

Fig. 7.—*B. conica* (Ashmead). Frontodorsal aspect of head of ♀.

Plate XIII

Fig. 8.—*B. compsilurae* (Crawford). Lateral aspect of head of ♀.

Fig. 9.—*B. coloradensis* (Cresson). Lateral aspect of head of ♂.

Fig. 10.—*B. weemsi,* new species. Apex of scutellum of ♀.

Fig. 11.—*B. fonscolombei* (Dufour). Inner aspect of hind femur of ♀. IT, inner tooth.

Fig. 12.—*B. fonscolombei* (Dufour). Lateral aspect of head of ♀.

Fig. 13.—*B. robusta* (Cresson). Lateral aspect of head of ♀.

Fig. 14.—*B. truncata,* new species. Apex of scutellum of ♀.

Fig. 15.—*B. comitator* (Walker). Lateral face of pronotum of ♀. Cx, fore coxa; Prp, prepectus.

Fig. 16.—*B. ovata* (Say). Lateral aspect of head of ♀.

Fig. 17.—*B. coloradensis* (Cresson). Lateral aspect of head of ♀.

Fig. 18.—*B. discreta* Gahan. Lateral aspect of scutellum of ♀.

Fig. 19.—*B. ovata* (Say). Lateral face of pronotum of ♀. Cx, fore coxa; Prp, prepectus.

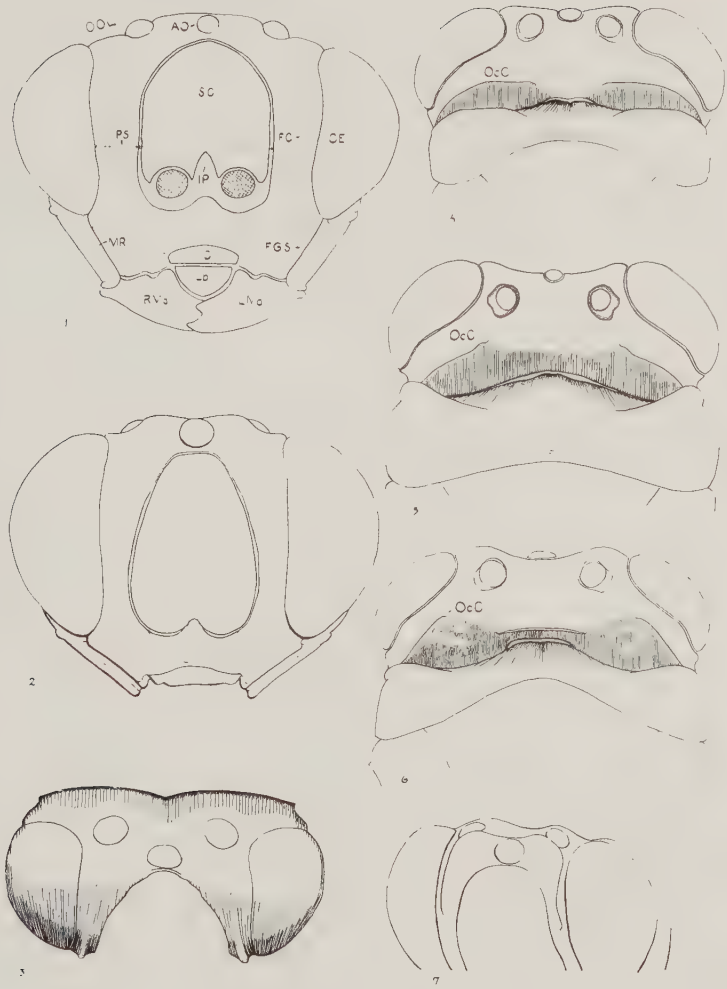
Plate XIV

Fig. 20.—*B. fonscolombei* (Dufour). Hind femur of ♀.

Fig. 21.—*B. robusta* (Cresson). Hind femur of ♀.

Fig. 22.—*B. ovata* (Say). Hind femur of ♀.

Fig. 23.—*B. russelli,* new species. Hind femur of ♀.



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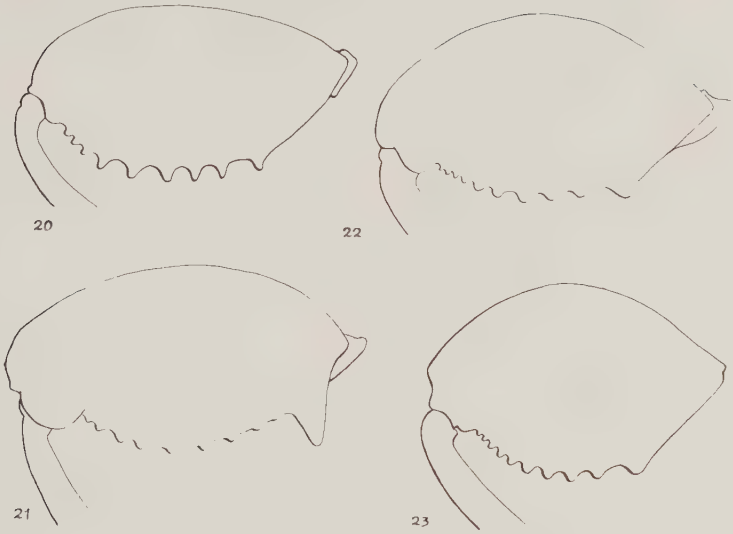

BURKS: GENUS BRACHYMERIA

A REVISION OF THE NORTH AMERICAN ELATERID BEETLES OF THE TRIBE ELATERINI (COLEOPTERA: ELATERIDAE)[1]

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Introduction

Judging from the fragmentary and scattered literature on the tribe Elaterini, a revision of this group at the present time is warranted. The purpose of this study is to review the species of the group, redescribe them in modern terms, construct keys for the separation of genera and species, and make other emendations which will contribute to the understanding of the group.

One problem in the revision of this tribe is the loss of Say's type specimens. However, LeConte's careful review of all Say's work offers a valid reference to Say's species. Treatment of Say's species in this present study, therefore, rests on the authority of LeConte and a study of Say's original descriptions.

As it was not feasible to examine types of European species which are the type species of Nearctic genera, it was necessary to rely on literature and the examination of congeneric North American species to establish, as far as possible, that a given species under consideration agreed with the genotype.

LeConte, Horn, and Schaeffer described several species of the Elaterini. The types in the LeConte collection at the Museum of Comparative Zoology were studied and compared; the Horn collection in the Academy of Natural Sciences of Philadelphia was examined as were the Schaeffer types in the United States National Museum. Other North American types and/or paratypes were also studied. Numerous additional specimens were examined from various museums in North America.

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[1] This article was composed for the fulfillment of the publication requirement for the degree of Doctor of Philosophy in the Graduate School of Arts and Sciences of the Catholic University of America, Washington, D. C.

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In the treatment of each species I have given only the name, genus to which it belongs, its present taxonomic position, the reference to the original description, and the synonymy of North American names. For complete bibliographic and synonymic information the reader is referred to Junk-Schenkling *Coleopterorum Catalogus*, Elateridae I, Pars 80, 1925, and II, Pars 88, 1927. It should be pointed out, however, that the synonymy given in this catalogue does not conform with the currently followed rules of nomenclature.

Distribution data as here given are necessarily incomplete being restricted to the data available on the locality labels of the specimens examined. The maps (Plate XVIII) indicate the distribution of the specimens examined in this study, and this is also summarized in the text. Each symbol plotted on a map represents a collection site; more extensive collecting will, no doubt, give a more complete distributional pattern.

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Diagnostic Characters of Adults (Morphology)

Even though certain morphological characteristics are selected as diagnostic, the range of variation of these characters must be considered in the study of a given taxon. It is the task of the systematist to determine when these variations are taxonomically significant.

The following characters are useful in determining the various taxa in the tribe Elaterini: pubescence, sculpture, form of antennae, pronotum, elytra, ventral surface of the body, secondary sexual characteristics, and male genitalia.

The male genitalia have been previously used to a limited degree in this group. Because of their useful taxonomic value in separating genera and species and in showing relationships in and among genera and species this characteristic is extensively used in the present study.

Lindroth and Palmer (1956) pointed out that in the Coleoptera the male genital tube is composed of sclerites and membranes arranged around the terminal portion of the ejaculatory duct. The ninth abdominal segment is usually part of this apparatus and is called the genital segment. In the elaterids the male genitalia are of the trilobate type made up of the following parts: tegmen or basal portion of the structure which is well developed or sclerotized, median lobe, and a shorter lateral lobe on either side of the median lobe. The distal subapical margins of the lateral lobes are usually beset with characteristic sensorial setae. Van Zwaluwenburg (1959) stated that when the lateral lobes are expanded apically, the prominence on the outer margin below the constriction at the base of the expansion is referred to as the shoulder; the lower angle of the apical expansion is called the "subapical angle"; when acute, it was termed by Neboiss (1957) as an apical hook. The male genitalia possess valuable taxonomic characters, such as shape of basal piece, shape and relative

width of median lobe, shape of lateral lobes, and occasionally the arrangement of setae. The generic and/or specific descriptions contain additional comments on this structure for each group.

Taxonomy

The tribe Elaterini here considered includes six North American genera: *Elater*, *Parallelostethus*, *Diplostethus*, *Orthostethus*, *Neotrichophorus*, and *Sericus*.

Careful scrutiny and study of the external morphology of both males and females along with a thorough study of the male genitalia indicate that these genera form a tribal unit.

Description of the Tribe Elaterini.—Antennae usually serrate, rarely subserrate or filiform, second segment one-third to one-half the length of the third; labrum free, convex, entirely or slightly emarginate; anterior angle of frons absent in middle above labrum, mandibles short, simple, rarely bifid, never extending far beyond labrum; prosternal lobe present; mesocoxae separated; meso-metathoracic suture well defined; metasternum truncate anteriorly, metepimeron narrow, metacoxal plates gradually dilated inwards, posterior margin toothed or rounded on inner third or entire; first segment of tarsi usually longest, tarsal claws simple, without setae; scutellum more or less shield-shaped, not cordate; abdomen with five visible sternites.

The above combination of characters will readily separate this tribe from all those considered by Schwarz (1907) in Genera Insectorum.

Figure 1 on Plate XV is a ventral view of *Elater abruptus* and Figure 2 on Plate XV is a dorsal view of the same species. These two figures exhibit the external morphology represented by this group. *Elater ater* is the first species discussed in the paper, so in order to have an initial point of reference to illustrate the morphological feature under discussion, it will be necessary to refer to some of the structures of *Elater abruptus*.

Key to Genera of North American Elaterini

1. Prosternal sutures excavated in front (Plate XV, Fig. 3), lateral margins straight, meeting anterior border of prosternal suture; metacoxal plates nearly same width throughout ..... *Sericus*, p. 310
   Prosternal sutures not excavated in front 2
2. Sides of mesosternal cavity parallel and nearly horizontal (Plate XV, Fig. 4) ..... *Parallelostethus*, p. 289
   Sides of mesosternal cavity divergent and sloping 3
3. Prosternal process with a ventral tooth immediately behind procoxae (Plate XV, Fig. 5) ..... *Diplostethus*, p. 295
   Prosternal process not toothed near procoxae 4

4. Sides of mesosternal cavity protruding and suddenly declivous anteriorly (Plate XV, Fig. 6) ..... *Orthostethus*, p. 306
   Sides of mesosternal cavity divergent and gradually declivous anteriorly 5
5. Metacoxal plates slightly to moderately toothed on inner third (Plate XV, Fig. 7) ..... *Elater*, p. 279
   Metacoxal plates rounded on inner third, sides of mesosternal cavity elevated to form sharp ridge (Plate XV, Fig. 8) *Neotrichophorus*, p. 298

Genus **ELATER** Linnaeus

Elater Linnaeus, 1758, Syst. Nat. ed. 10 (1), p. 404.

Type of genus.—*Elater ferrugineus* Fabricius, 1801, Syst. Eleuth., Vol. 2, p. 225. (Designated by Latreille, 1810, p. 426.) (= *Elater ferrugineus* Linnaeus, 1758, Syst. Nat. ed. 10 (1), p. 405.)

Type locality.—Sweden. (Not restricted further.)

Ludius Berthold, 1827, Latreille's Nat. Fam. Thier., p. 336.

Type of genus.—*Elater ferrugineus* Fabricius, 1801, Syst. Eleuth., Vol. 2, p. 225. (Monobasic.) (Isogenotypic with *Elater* Linnaeus, 1758 and *Steatoderus* Dejean, 1833.)

Steatoderus Dejean, 1833, Cat. Col., ed. 2, p. 92.

Type of genus.—*Elater ferrugineus* Fabricius, 1801, Syst. Eleuth., Vol. 2, p. 225. (Monobasic.) (Isogenotypic with *Elater* Linnaeus, 1758 and *Ludius* Berthold, 1827.)

The pronotum is moderately convex, abruptly or moderately narrowing anteriorly. The sides of the mesosternal cavity are divergent and gradually declivous anteriorly, a characteristic which immediately separates this genus from *Parallelostethus* in which the sides of the mesosternal cavity are parallel. The metacoxal plates are slightly to moderately toothed on inner third. This genus differs from *Diplostethus* in having only a single anteapical tooth on the prosternal process which is straighter and lacks the sharp declivity near the procoxal cavities as in *Diplostethus*. The sides of the mesosternal cavity are not elevated to form sharp ridges as in *Neotrichophorus*.

Description of genus.—Form slightly elongate, slightly convex, moderately robust to elongate, convex, robust; sparsely to densely umbilicately punctate, pubescent, color reddish brown to shining black. Females generally larger than males, but with shorter antennae.

Head rounded in front, directed downward, eyes prominent, moderately to slightly protruding. Antennae extending from two-thirds the length of pronotum to two segments beyond, moderately to deeply serrate, inserted in reniform pits anterior to eyes and beneath the margin of front. Second segment shorter than third, second and third equaling slightly more than half of fourth to equaling fourth; segments four through ten similar, eleventh segment constricted, suggesting pseudo-twelfth segment. Mandibles large, entire, acute at apex, simple, strongly curved, left overlying right.

Pronotum subquadrate, median length subequal to, equal to, or longer than median width; lateral margins slightly prominent to prominent, ranging from partially visible in dorsal view and slightly converging anteriorly; posterior angles slightly divergent to strongly divergent. Pronotum slightly convex to moderately convex. Pronotal punctures small, shallow to large, deep; prosternal lobe moderate to large, narrowly to broadly rounded, more or less deflexed; prosternal sutures single, slightly raised. Sides of mesosternal cavity divergent and gradually declivous anteriorly; the anterior border of mesosternum transversely thickened, with median bifid apex, which indicates the most anterior portion of mesosternal cavity, with subapical excavation between knobs of bifid apex; anterio-lateral margins split transversely into anterior-dorsal and post-anterior ventral borders giving a step-like or drop-off appearance in ventral view, anteriolateral margins slope away anteriorly to meet procoxal cavities. Metacoxal plates slightly to moderately toothed on inner third of posterior borders, slightly declivous to lateral margins. Legs slender, approximately same size throughout. Elytra elongate, apices conjointly rounded, striated or non-striated, pubescent.

General appearance of male genitalia short and moderately stout to long and slender. Basal piece with large unsclerotized area, U-shaped or V-shaped. Median lobe with acute deflexed apex. Lateral lobes slightly expanded subapically or not expanded. Chitinized rod projecting slightly to one-fourth of its length beyond base of median lobe.

Discussion.—This genus contains four species which seem to fall into two distinct groups (see Table 1). *Elater abruptus* and *Elater pinguis* possess characteristics that are similar but which in turn differ markedly from the characteristics possessed in common by *Elater lecontei* and *Elater ater*.

Key to the Species of *Elater*

1. Antennae as long or longer than pronotum and deeply serrate; pronotum broader than long, moderately convex dorsally; abruptly narrowing on anterior fourth 2

   Antennae shorter than pronotum and moderately serrate, pronotum longer than broad, strongly convex dorsally; narrowing gradually anteriorly 3

2. Carina complete on anterior border of pronotum, lateral margins of pronotum moderately distinct in dorsal view (Plate XVI, Fig. 1); elytra without any indication of striae ..... *ater*
   Carina on lateral one-third of anterior border of pronotum, lateral margins of pronotum clearly distinct in dorsal view (Plate XVI, Fig. 3), elytra with striae in the form of larger, nonsetiferous punctures *lecontei*
3. Pronotum with large, umbilicate punctures (Plate XVI, Fig. 4); fuscous black ..... *pinguis*
   Pronotum with small, umbilicate punctures (Plate XVI, Fig. 2); shiny reddish brown to shiny black ..... *abruptus*

Elater ater (Candèze, 1865)

Ludius ater Candèze, 1865, Mem. Cour. Acad. Roy. Sci. Belgique, 17: 55. (Location of type: British Museum (Natural History), London.)

Type locality.—Sacramento, California.

The antennae are deeply serrated and longer than the pronotum. The pronotum is broader than long. This species is similar to *Elater lecontei* in size and general shape but differs from it in having the carina complete on anterior border of pronotum and in lacking elytral striae. It differs from the remaining North American *Elater* by having the pronotum abruptly narrowing on the anterior fourth rather than gradually narrowing anteriorly.

Description of species.—Length 18.5 to 26.5 mm.; width 5.5 to 7 mm. Body elongate, robust, convex. Color ranges from dark brown to black on dorsal surface, slightly lighter beneath. Sparsely clothed with moderately long, dark, oblique setae with brownish tips directed posteriorly.

Head densely umbilicately punctate, punctures approximately twice the size of interstices, surface moderately alutaceous. Antennae longer than pronotum, extending two segments beyond posterior angle, deeply serrate; second and third combined equal to just slightly more than half of fourth in males, subequal to fourth in females. Mandibles lighter than dorsal surface.

Median width of pronotum slightly longer than median length (Plate XVI, Fig. 1), widest across posterior angles; lateral margins prominent, visible in dorsal view, slightly sinuate on basal third, slightly converging anteriorly; anterior angles subtruncate, posterior angles acute, prolonged, slightly diverging posteriorly, each with carina, which becomes more or less confluent with outer border of angle before reaching base. Pronotum slightly convex, with very faint median longitudinal line; densely, umbilicately punctate, punctures sparse at base, interstices subequal to punctures, surface weakly alutaceous; a fine, oblique dark brown, recurvate seta directed posteriorly from center of each puncture. Pronotal epipleura (Plate

XV, Fig. 1, PE) moderately punctate, except for small impunctate area just anterior to posterior margin. Setae arising from punctures obliquely directed anterio-laterally. Posterior margin oblique, sinuate with acute projection just anterior to center of margin, directed posteriorly. Prosternum (Plate XV, Fig. 1, St1) convex with prosternal lobe, lateral hump (tubercle) on either side on apical third; very coarsely, very densely umbilicately punctate, generally punctures more than twice the size of interstices, fine setae arising from the punctures, suberect, directed forward, punctures absent from area beginning at basal third on the mid-ventral border along median longitudinal plane of prosternum, continuing almost to tip; surface shiny. Prosternal lobe moderate, acutely rounded, moderately deflexed apically, separated by transverse lightly depressed line. Surface of mesosternum (Plate XV, Fig. 1, St2) behind post-anterior ventral border transversely ridged laterally, gradually diminishing inwardly, becomes evanescent before reaching side of mesosternal cavity. Posterior margin defined by regularly rounded separated coxal cavities, posterior part of mesosternum ends at its narrowest point between coxae, margin of mesosternum marked by transverse, deeply incised meso-metasternal suture. Sides of mesosternal cavity stout, moderately diverging anteriorly. Immediately posterior to meso-metasternal suture, sub-apical ventral surface rounded, diverging posteriorly, not carinate. Mesepisternum (Plate XV, Fig. 1, Eps2) roughly triangular, anterior angle acute, slightly deflexed at tip, projecting beyond anterio-lateral border of mesosternum; exterior angle rounded; anterior margin straight on interior two-thirds, moderately arcuate on exterior third; surface with arcuate depression on anterio-ventral portion; interior margin concave; exterior margin convex, anterior portion with slight marginal cleft just below exterior angle into which inflexed margin of elytron fits when at rest. Mesepimeron (Plate XV, Fig. 1, Epm2) with short anterior transverse margin; interior margin clearly divided into posterior and anterior portions, anterio-interior portion concave, posterio-interior portion partially closes coxal cavity. Posterior margin concave, sulcate to receive margin of elytron; anterior outermost edge of this marginal depression meets anterior margin to form an acute external angle, posterior outer depression edge meets posterior margin to form rounded posterior angle. Metasternum (Plate XV, Fig. 1, St3) truncate anteriorly, with slight lateral apical grooves along coxal cavities becoming ridged posteriorly; metacoxal plates slightly toothed on inner third of posterior borders, slightly declivous to lateral margins. Metasternum densely, finely punctate, clothed with thick long, very fine oblique hairs, directed posteriorly, arising from hemispherical punctures, interstices weakly alutaceous. Tarsi with first segment longer than second, second longer than third, third longer than fourth; fifth longer than fourth, but shorter than first; each tarsal segment moderately pubescent on ventral aspect. Scutellum (Plate XV, Fig. 2, Scl) somewhat shield-shaped (more pronounced in females), longer than broad, widest at apical third in females, at base in males, slightly sinuate on basal third, gradually tapering to obtuse apex,

with faint trace of median longitudinal carina, slight median apical depression, moderately punctate, punctures approximately equal. Elytra (Plate XV, Fig. 2, El) elongate, broader than thorax, over two and one-half times longer than broad, sides parallel on basal quarter, thence gradually tapering, conjointly broadly rounded at apex, in females, sutural angles slightly formed, in males, base indented in scutellar area. Sutural striae feebly present at base, otherwise striae obsolete. Elytra densely umbilicately punctate, punctures hemispherical, each with oblique seta, as a result overall structure appears rugose; interstices three times as large as punctures, surface weakly alutaceous.

Abdomen with lateral margins gradually tapering posteriorly, convergent at apex; apex rounded, clothed with oblique setae. Generally abdomen sparsely clothed with medium oblique setae, directed posteriorly, arising from hemispherical punctures; surface weakly alutaceous. First sternite partially covered by metacoxal plates and trochantins, second subequal to third, third subequal to fourth, fifth sternite approximately twice the length of second.

General appearance of male genitalia (Plate XVII, Fig. 1) very slender with margins of median and lateral lobes straight to slightly sinuate apically. Median lobe (Plate XVII, Fig. 1, p) longer than lateral lobes (Plate XVII, Fig. 1, pm), apex acute, deflexed; lateral lobes slightly expanded subapically, large ventro-median setae directed medianly. Basal piece (Plate XVII, Fig. 1, b,pc) with large unsclerotized U-shaped area. Chitinized rods linear, projecting slightly beyond base of median lobe.

Distribution.—(Plate XVIII, Map 1.) This species is known throughout eastern California and Arizona.

Specimens examined (32).—*United States:* **Arizona,** Santa Cruz Co., Madera Cn., Santa Rita Mountains, 1; **California,** Alameda Co., Livermore 8, Niles 1, Butte Co., Chico, 1, Riverside Co., Corona, 1, San Diego Co., Poway, 1, Santa Clara Co., Silver Creek Hills, 2, Sonoma Co., Sobre Vista, 1, Tulare Co., Kaweah, 1, Monson, 3, Yolo Co., Davis, 12.

Elater lecontei (Horn, 1871)

Ludius lecontei Horn, 1871, Trans. American Ent. Soc., 3: 313. (Location of type: Academy of Natural Sciences, Philadelphia, Pennsylvania, type no. 3368 [3].)

Type locality.—San Diego, California.

This species resembles *Elater ater* in having the lateral margins of pronotum visible in dorsal view. It differs from *Elater ater* in having the carina on lateral one-third only of anterior border of pronotum and having distinct elytral striae. It differs

[3] This specimen, a male from San Diego, California, is hereby designated lectotype.

from the remaining North American species of *Elater* by having the pronotum abruptly narrowing on the anterior fourth rather than gradually narrowing anteriorly.

Description of species.—Length 21 to 31.5 mm.; width 5.2 to 7 mm. Body elongate, robust, slightly convex. Color ranges from reddish brown to dark brown on dorsal surface, somewhat lighter beneath. Sparsely clothed with short, brown, oblique setae arising in each puncture, directed posteriorly.

Head moderately umbilicately punctate, interstices two times larger than punctures, surface moderately alutaceous. Antennae longer than pronotum, extending two segments beyond posterior angle in males, in females extending to posterior angles (eleven segmented), deeply serrate, second plus third shorter than fourth.

Median width of pronotum (Plate XVI, Fig. 3) slightly longer than median length (width 1.05 times longer than length), widest across posterior angles; lateral margins prominent, clearly visible in dorsal view, slightly sinuate on basal third, converging slightly anteriorly; anterior angles subtruncate, posterior angles acute, moderately diverging posteriorly, each with an oblique carina which becomes more or less confluent with inner border of angle before reaching vertex, vertex with fovea occupying total angular space out of which several large setae arise. Pronotum slightly convex, with very faint median longitudinal line; moderately umbilicately punctate, punctures sparse at base, interstices approximately twice the size of puncture, space moderately alutaceous. A fine oblique, recurvate seta directed posteriorly from each puncture. Pronotal epipleura moderately punctate on anterior third, gradually becoming sparsely punctate, finally punctures become evanescent on posterior third (impunctate). Posterior margin oblique, sinuate, with posteriorly directed tubercle one-third of distance from pronotal suture. Setae arising from the punctures directed anteriorly. Prosternum moderately convex, very coarsely, very densely umbilicately punctate, generally punctures more than twice the size of interstices. Prosternal lobe acutely rounded, moderately deflexed apically. Setae in punctures suberect and directed forward, punctures sparse on ventral aspect of prosternal process. Prosternal lobe moderate, separated by transverse depressed line. Prosternal sutures raised, moderately sinuated slightly anterio-lateral to procoxal cavities. Surface of mesosternum behind post-anterior ventral border obliquely-transversely ridged, forming triangular shaped raised area, ridge continuous to mesosternal cavity. Posterior margin defined by regularly rounded separated coxal cavities, posterior part of mesosternum ends at its narrowest point approximately midway between coxae, easily noticeable median tubercle connecting meso- and metasternum; anterio-lateral margins of metasternum strongly carinate thereby forming deep depression. Mesepisternum roughly triangular, anterior angle acute, slightly deflexed at apex, projects beyond anterio-lateral border of mesosternum; exterior angle rounded, anterior margin straight on interior half, slightly arcuate on exterior half, with sinuate depression on interior anterio-ventral border. Interior margin concave, exterior margin convex; on anterior portion of exterior margin, slight marginal cleft just below exterior angle into which inflexed margin of elytron fits when at rest. Mesepimeron anterior margin short, transverse, interior margin

divided into posterior and anterior portions; anterio-interior portion concave, posterio-interior portion transverse, partially closes coxal cavity; posterior margin concave, contiguous with metasternum and metepisternum; exterior margin concave, sulcate to receive margin of elytron, the anterior outermost edge of this marginal cleft combines with posterior margin to form rounded posterior angle. Metasternum truncate anteriorly; apex not carinate, with visible connection between meso- and metasternum. Anterio-lateral margins strongly carinate, sub-apical ventral surface slightly depressed (concave). Metasternum densely, finely punctate, clothed with thick, long, light brown, very fine, oblique hairs, directed posteriorly, which arise from hemispherical punctures, interstices moderately alutaceous. Metacoxal plates moderately toothed. Legs slender, femur approximately same size throughout. Tarsi as in *Elater ater*. Scutellum bell shaped, longer than wide, widest at base, slightly sinuate on apical third, gradually tapering to obtuse apex, sparsely punctate, punctures gradually smaller from apex to base. Elytra elongate, broader than thorax, three times longer than broad, sides parallel on basal half, gradually tapering to apex; apex conjointly broadly rounded, faintly sinuate, acuminate sutural angles produced along sutural margin, strongly acuminate at apex, base indented around scutellum. Elytra with nine striae in the form of larger non-setiferous punctures; intervals six times broader than punctures, biseriately umbilicately punctured, surface strongly alutaceous; clothed with short, sparse, reddish brown, oblique recurvate setae directed posteriorly; arising from each puncture. Sutural striae present from base to apex of each elytron.

Abdominal sternites similar to *Elater ater*.

Male genitalia (Plate XVII, Fig. 2) slender in general appearance with margins of median and lateral lobes more sinuate than *Elater ater*. Median lobe longer than lateral lobes, apex acute, deflexed; lateral lobes gradually tapering apically, large ventro-median setae directed laterally. Chitinized rods linear, projecting slightly beyond base of median lobe.

Distribution.—(Plate XVIII, Map 1.) This species is known throughout southern California and in southern Arizona.

Specimens examined (48).—*United States:* **Arizona,** Santa Cruz Co., Madera Cn., Santa Rita Mountains, 1, Yuma Co., Yuma, 1; **California,** Kern Co., Bakersfield, 1, Lebec, 1, Poso Creek, 1, Tejon Canyon, 1, Monterey Co., Carmel, 1, Los Angeles Co., Claremont, 4, Mount Wilson, 2, Pasadena, 4 Sierra Madre, 1, Riverside Co., Corona, 15, Keen Camp, 1, San Diego Co., 2, Boulevard, 1, Poway, 2, Santa Barbara Co., Santa Barbara, 1, Santa Cruz Co., Santa Cruz, 1, Yolo Co., Davis, 7.

Elater pinguis (Horn, 1884)

Ludius pinguis Horn, 1884, Trans. American Ent. Soc., 12: 46, 47. (Location of type: Academy of Natural Sciences of Philadelphia, Pennsylvania, type no. 3369[4].)

Type locality.—Near Portland, Oregon.

This species is fuscous black, with moderately serrated antennae which are shorter than pronotum; the pronotum longer than broad. It differs from *Elater abruptus* by having larger umbilicate punctures on the pronotum and from the remaining North American species of *Elater* by having the pronotum narrowing gradually anteriorly rather than abruptly narrowing on the anterior fourth.

Description of species.—Length 19–30 mm.; width 6–8 mm. Body elongate, slightly obovate, slightly robust, moderately convex. Black on dorsal surface; ventral surface, legs, mandibles, slightly lighter. Densely clothed with fine, short, light-silky pubescence obliquely directed posteriorly.

Head moderately umbilicately punctate, punctures larger than interstices, surface moderately alutaceous, setae from punctures obliquely directed anteriorly. Eyes moderately protruding. Antennae extending four-fifths of length of pronotum, moderately serrate; second and third segment combined subequal to fourth. Maxillary palpi tetramerous, apical segment triangular, long, slender, widest on apical quarter.

Pronotum (Plate XVII, Fig. 5) narrower anteriorly than posteriorly; median length subequal to median width, widest at posterior angles, lateral margins slightly visible in dorsal view on basal third, moderately converging anteriorly; anterior angles subtruncate, posterior angles acute, angular processes slightly diverging posteriorly, each with a prominent carina, which becomes confluent with outer and inner border of angle, just before reaching the base, base of angle with large fovea from which several large setae arise. Pronotum strongly convex with very faint median longitudinal line, with large, dense, umbilicate punctures, punctures approximately twice as large as interstices, fine dark, suberect, recurvate setae from each puncture, directed posteriorly; surface moderately alutaceous. Pronotal epipleura densely umbilicately punctate except small impunctate area along posterior margin, commencing posterio-laterally from where prosternal sutures end in small foveae near anterior third of coxal cavities, outer groove continues posteriorly; posterior margin oblique, sinuate, with median moderate projection on apical two-fifths of margin, projection posteriorly directed. Prosternum convex, prosternal lobe broadly rounded, slightly deflexed apically. Surface of mesosternum behind post-anterior ventral border not transversely ridged, but gradually declivous to dorsal portion; posterior margin

[4] This specimen, a female from near Portland, Oregon, is hereby designated lectotype.

defined by regularly rounded, separated coxal cavities, posterior part of mesosternum ends at its narrowest point approximately three-fourths of the distance between coxae; margin marked by transverse, deeply incised meso-metasternal suture, anterior to suture sides of mesosternal cavity moderately stout, slightly diverging anteriorly. Mesepisternum crudely triangular; anterior angle acute, not deflexed at apex, not projecting beyond anterio-lateral border of mesosternum; anterior margin straight on interior half, strongly raised, arcuate on slightly deflexed exterior half. Exterior margin convex with slight marginal cleft just below exterior angle into which the inflexed portion of elytron fits when at rest. Mesepimeron with anterior transverse margin, interior margin divided into posterior and anterior portions partially closing coxal cavity. Posterior margin concave, contiguous with metasternum and metepisternum. Exterior margin concave, sulcate to receive inflexed margin of eljytron. Anterior outermost edge of marginal depression meets with exterior portion of anterior margin to form acute angle, posterior outer edge of depression meets with posterior margin to form posterior rounded angle contiguous with metepisternum. Apex of metasternum broadly truncate, not carinate, anterio-lateral margins feebly carinate, apical ventral surface flat. Metacoxal plates slightly toothed. Scutellum shield-shaped, sides parallel on basal two-thirds, gradually tapering to round apex, base slightly tumid; densely punctate, punctures closer and smaller on base than on apex, gradually increasing in size to apex. Elytra elongate-ovate, broader than thorax, sides parallel on basal two-thirds, gradually tapering to apex; apex conjointly rounded, apical angle slightly produced, approximately two and one-half times as long as broad, disk moderately convex. Elytra striate, densely sub-umbilicately punctate, punctures hemispherical and considerably smaller than punctures on pronotum, each with oblique setae, resulting in overall finely rugose appearance, interstices approximately twice as large as punctures, surface shiny and weakly alutaceous.

Lateral margins of abdomen gradually tapering posteriorly. Apex of fifth abdominal sternite broadly rounded, clothed with medium oblique setae, moderately punctate, surface moderately alutaceous; first visible sternite partially hidden by metacoxal plates, second longer than third, third longer than fourth, and fifth approximately twice the length of the second.

Median lobe of male genitalia (Plate XVIII, Fig. 3) acutely pointed at apex, apex sharply deflexed; base of median lobe slightly emarginate; lateral lobes subapically fringed with setae on exterior margins, apices slightly arcuate. Basal piece with large V-shaped unsclerotized area, base of V rounded. Chitinized rods prominent, projecting one-fourth of length below median lobe.

Distribution.—(Plate XVIII, Map 1.) This species is recorded from Pacific, California, which is in the northeastern portion of the state and also from Oregon.

Specimens examined (2).—*United States:* **California**, Eldorado Co., Pacific, 1; **Oregon**, 1.

Elater abruptus Say, 1825

Elater abruptus Say, 1825, Ann. Lyc. Nat. Hist. New York, 1: 253. (Type unknown.)

Ludius coracinus Germar, 1843, Zeitschr. Ent., 4: 47. Placed as synonym of *Elater abruptus* Say, 1825, LeConte, J. L., 1853, Rev. Elat. United States, Trans. American Phil. Soc., 10: 455.

Type locality.—" Boreal America ". (Not restricted further.)

The color range of this species is dark brown to shiny black with moderately serrated antennae which are shorter than pronotum and the pronotum is longer than broad. This species is very closely related to *Elater pinguis* but differs from it by having smaller umbilicate punctures on the pronotum. It differs from the remaining North American species of *Elater* by having the pronotum (Plate XVI, Fig. 6) gradually narrowing anteriorly rather than abruptly narrowing on the anterior fourth.

Description of species.—Length 15 to 22 mm.; width 5 to 7 mm. Body elongate, oblong, moderately robust, convex. Color ranges from dark brown to black on dorsal surface; ventral surface, legs, mandibles lighter. Densely clothed on pronotum and elytra with fine, reddish-brown shiny pubescence, obliquely directed posteriorly.

Head moderately umbilicately punctate, punctures small; interstices approximately twice as large as punctures, surface weakly alutaceous, setae from punctures obliquely directed anteriorly. Eyes as in *Elater pinguis*. Antennae extending two-thirds of length of pronotum, in females, slightly longer in males, moderately serrate; second and third segments combined subequal to fourth.

Pronotum as in *Elater pinguis* except umbilicate punctures smaller (Plate XVI, Fig. 2). Pronotal epipleura moderately umbilicately punctate except for area from middle of procoxal cavities to posterior margin of pronotal epipleura; prosternum convex, prosternal lobe broadly rounded, slightly deflexed apically. Mesosternum, mesepisternum and mesepimeron as in *Elater pinguis*. Metasternum moderately truncate, not carinate, metacoxal plates moderately toothed. Scutellum as in *Elater pinguis*. Elytra as in *Elater pinguis* with the exception of less distinct striae and smaller punctures; elytra substriate, sutural striae distinct at base only, densely subumbilicately punctate, punctures hemispherical and considerably smaller than on pronotum, each with oblique medium, reddish-brown setae directed posteriorly, as a result causing overall structure to appear rugose, interstices approximately twice as large as punctures, surface shiny, weakly alutaceous.

Apex of fifth abdominal sternite broadly rounded, clothed with fine oblique setae, moderately punctate, surface weakly alutaceous. First visible sternite partially hidden by metacoxal plates, fifth one and one-half times as long as fourth.

Median lobe of male genitalia (Plate XVII, Fig. 4) acutely pointed at apex, apex deflexed, base of median lobe not emarginate; lateral lobes subapically fringed with setae on exterior margins, apices slightly arcuate. Basal piece with large V-shaped unsclerotized area, base of V acute. Chitinized rods not very prominent, projecting just below base of median lobe.

Distribution.—(Plate XVIII, Map 1.) This species is known from Ontario, the New England states southward to Virginia and westward to Kansas; known also from California.

Specimens examined (76).—*Canada:* **Ontario,** Toronto, 4, Kingsmere, 1, Ormonde, 6. *United States:* **New Hampshire,** Grafton Co., Rumney, 4, Rockingham Co., Canobie Lake, 1, Strafford Co., Durham, 1; **Massachusetts,** Middlesex Co., Bedford, 1, Sherborn, 2, Norfolk Co., Brookline, 5; **Connecticut,** Hartford Co., Hartford, 1, Litchfield Co., Cornwall, 2; **New York,** Chemung Co., Breesport, 1, Erie Co., Buffalo, 1, Chafee, 2, Essex Co., Crown Point, 1, Greene Co., Onteora Mountain, 1, Niagara Co., Lockport, 1, Orange Co., West Point, 1, Tompkins Co., Ithaca, 1; **New Jersey,** Passaic Co., Clifton, 1, Salem Co., Alloway, 1; **Pennsylvania,** Adams Co., Arendtsville, 2, Allegheny Co., 5, Montgomery Co., Abington, 2, Philadelphia Co., Philadelphia, 7, Roxborough, 1; **Maryland,** Montgomery Co., Plummers Island, 5; **Washington,** D. C., 1; **Virginia,** Fauquier Co., Paris, 1; **Kentucky,** 1, **Ohio,** 4; **Indiana,** Kosciusko Co., Winona Lake, 1, St. Joseph Co., Walkerton, 1; **Illinois,** McLean Co., Bloomington, 1; **Minnesota,** 1; **Missouri,** 1; **Kansas,** Douglas Co., 1, Riley Co., 1; **California,** Los Angeles Co., Highland Park, 1.

Genus **PARALLELOSTETHUS** O. Schwarz

Parallelostethus O. Schwarz, 1907, *In* Wytsman, Gen. Ins., fasc. 46c, pp. 252, 258.

Type of genus.—*Elater attenuatus* Say, 1825, Ann. Lyc. New York, 1(2): 257. (Designated by Hyslop, 1921, 662.)

Type locality.—United States. (Not restricted further.)

Genus *Parallelostethus* is readily recognized because the sides of the mesosternal cavity are parallel, whereas in *Elater* they are divergent, and in *Orthostethus* they are strongly divergent and abruptly declivous. This genus differs from *Diplostethus* by having only a single anteapical tooth on the prosternal process and the apex of the elytra are strongly acuminate. These characteristics facilitate rapid identification of this group.

Description of genus.—Form moderately robust, convex, oblong-ovate.

Head rounded, eyes prominent, protruding slightly, mouth parts directed downward, mandibles acute at apex and simple; antennae serrate, insertions spaciously separated, inserted in reniform pits anterior to eyes and beneath the margin of the front. Eleventh segment in males constricted, suggesting pseudo-twelfth segment, apically elongated in females.

Table 1. Summation of comparative characters of species of *Elater*.

Elater ater	*Elater lecontei*	*Elater pinguis*	*Elater abruptus*
1a. General form—body elongate, robust	1a. General form—body elongate, robust	1a. General form—body elongate, slightly obovate, slightly robust	1a. General form—body slightly elongate, oblong, moderately robust
1b. Size—18.5–26.5 mm.	1b. Size—21–31.5 mm.	1b. Size—19–30 mm.	1b. Size—15–22 mm.
1c. Punctation—large umbilicate punctures. Elytra—densely umbilicately punctate, punctures hemispherical	1c. Punctation—moderate, umbilicate punctures. Elytra—striae biseriately umbilicately punctate	1c. Punctation—large, umbilicate punctures. Elytra—punctures hemispherical, smaller than those on pronotum	1c. Punctation—pronotum moderate, umbilicate punctures. Elytra—punctures hemispherical, smaller than those on pronotum
2. Color—dark brown to black	2. Color—reddish-brown to dark brown	2. Color—dusky black	2. Color—dark brown to shiny black
3a. Antennae—extending two segments beyond pronotum	3a. Antennae—in males extending two segments beyond posterior angles of pronotum; in females extending to posterior angles	3a. Antennae—extending four-fifths of length of pronotum	3a. Antennae—in males extending two-thirds of length of pronotum; in females slightly longer
3b. Second and third combined equal to half of segment four in males, subequal to fourth in females	3b. Second and third segments shorter than fourth	3b. Second and third segments subequal to fourth	3b. Second and third segments combined subequal to fourth

Table 1, continued.

Elater ater	*Elater lecontei*	*Elater pinguis*	*Elater abruptus*
4a. Pronotum—abruptly narrowing anteriorly	4a. Pronotum—abruptly narrowing anteriorly	4a. Pronotum—narrowing gradually anteriorly	4a. Pronotum—narrowing gradually anteriorly
4b. Lateral margins visible in dorsal view	4b. Entire lateral margin clearly visible in dorsal view	4b. Lateral margins slightly visible in dorsal view on basal third only	4b. Lateral margins visible in dorsal view on basal third only
5. Apex of elytra conjointly broadly rounded; sutural angles slightly acuminate in males.	5. Apex of elytra conjointly broadly rounded; sutural angles acuminate	5. Apex of elytra conjointly rounded	5. Apex of elytra rounded, apical angles slightly produced
6. Male genitalia—long, slender; large unsclerotized open U-shaped area	6. Male genitalia—long, moderately slender; large unsclerotized open U-shaped area	6. Male genitalia—short, moderately stout; large unsclerotized V-shaped basal area	6. Male genitalia—short, moderately stout; large unsclerotized V-shaped basal area

Median length of pronotum slightly longer than median width in males, equal in females, widest across posterior angles, with sides slightly sinuate at about posterior one-fifth, then moderately converging anteriorly; side margin curved under and becoming evanescent. Prothorax convex, posterior angles moderately carinate, carina extending to extremity of angle. Pronotal punctures irregular; pubescence medium and dense. Prosternal lobe medium; prosternal sutures single, slightly elevated. Sides of mesosternal cavity parallel and horizontal. Metacoxal plates rather abruptly widened inwardly, with a tooth-like projection on inner third of their posterior margins. Elytra transversely convex, elongate, apex strongly acuminate, coarsely punctate.

Male genitalia trilobate, basal piece slightly longer than broad. Lateral lobes with subapical medio-ventral outer and dorso-lateral borders bearing hairs. Median lobe pointed, longer than lateral lobes, deflexed at apex; orifice of ejaculatory duct subapical.

Discussion.—Genus *Parallelostethus* was erected by Schwarz (1907) for the species having parallel-sided mesosternal cavities. Schaeffer (1916) stated that *Ludius attenuatus* and five Asiatic species are referred to this genus. This genus is represented in North America by a single species, *Parallelostethus attenuatus* (Say, 1825). Morphological variations among the populations of this species are noticeable but are not significant enough to constitute a species difference. Variations worthy of note are range of color from reddish brown to black and the relative amount of chitinization of the basal piece of the male genitalia. Members of this species that are black have a heavily chitinized basal piece as compared with the basal piece of the reddish brown members. From the specimens examined it seems that the black organisms are smaller than the reddish brown ones. Careful observation did not reveal that variations were associated with distribution because both types occur in the same range. Males are generally smaller than females. Beginning with the fourth antennal segment and continuous through the ultimate segment, each antennal segment of males is beset with densely arranged medium erect hairs on ventral aspect as compared with medium suberect hairs on ventral aspect of female antennae beginning at the fourth and continuing through the penultimate segment; segments four through ten also have several conspicuously large setae on their distal borders. The variations here described are consistently correlated with specific distinguishable external characteristics.

Parallelostethus attenuatus (Say, 1825)

Elater attenuatus Say, 1825, Ann. Lyc. Nat. Hist. New York, 1(2): 257.

Type locality.—United States. (Not restricted further.)

Ludius fuscus Castelnau, 1840, Hist. Nat. Ins. Col. 1, p. 240. Placed as synonym of *Elater attenuatus* Say, 1825, Candèze, E. C., 1863, Mon. Elat., Vol. 4, p. 299.

Type locality.—"Boreal America". (Not restricted further.)

This species is easily identified because of its parallel-sided mesosternal cavity and by having the apex of the elytron strongly acuminate. The usually dark reddish-brown color is also an aid in its identification. Some members, however, are black. In such cases the structural features are sufficient for recognition.

Description of species.—Length 15–23 mm.; width 4.25–6.11 mm. Body elongated and moderately robust. General color reddish-brown with elytra tipped with black to entirely very dark brown or black. Thickly clothed with dark brown, suberect setae which may appear silky depending on the angulation of the light.

Head moderately punctate. Antennae reaching three-fourths of the distance of pronotum, moderately serrate; second segment shorter than third, second and third combined subequal to fourth in males, longer than fourth in females.

Pronotal median length in males 1.02 times median width; in females median width equals median length, widest across hind angles; lateral margins at posterior angles prominent, gradually diminishing anteriorly, sides rounded on apical quarter; anterior angles obtuse, posterior angles acute, prominently extended to outer basal portion of pronotum, each with median carina; along the median longitudinal axis at the base of the pronotum is a feeble carina in males and in females a very faint median depression; dorsal surface irregularly punctate with umbilicate punctures, interstices slightly larger than punctures, disk closely punctate, moderately clothed with median suberect hairs. Prosternal lobe separated by slight transverse depressed line, prosternum slightly convex. Sides of mesosternal cavity parallel and horizontal; mesepimeron more or less trapeziform, attaining coxae of mesothorax; mesocoxal cavities separated. scutellum bell-shaped at base, slightly tapering at apex; median length longer than median width. Elytra elongate, attenuate at apex, scutellar area depressed, irregularly punctate; striae obsolete, densely clothed with medium suberect hairs, intervals alutaceous, slightly larger than punctures.

Abdomen coarsely punctate, sparsely clothed with large suberect setae.

Male genitalia (Plate XVII, Fig. 5) with median lobe pointed, longer than lateral lobes, deflexed at apex with two struts at base. Ejaculatory duct dorsal, orifice subapical; median lobe attached to basal piece by a

membrane and to lateral lobes by a sclerotized inner infold of the lateral lobes, connecting at basal one-fourth of median lobe; lateral lobes partially enveloping median lobe; basal piece with U-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 2.) This species is recorded from Massachusetts to New York southward to Georgia and westward to Kansas and Oklahoma and also from California.

Specimens examined (212).—*United States:* **Massachusetts,** Hampden Co., Agawam, 1, Wilbraham, 1; **Connecticut,** Litchfield Co., Cornwall, 13; **New York,** Cayuga Co., Spring Lake, 1, Greene Co., Catskill Mountains, 2, Niagara Co., Youngstown, 2, Onondaga Co., Dolby's Station near Manlius, 2, Queens Co., Jamaica, Long Island, 1, Tompkins Co., McLean, 2, Westchester Co., Peekskill, 3, Yonkers, 2, Montrose, 1; **Pennsylvania,** Adams Co., Arendtsville, 2, Allegheny Co., Pittsburgh, 13, Centre Co., State College, 1, Dauphin Co., Linglestown, 7, Delaware Co., Media, 1, Franklin Co., Pen Mar, 1, Northampton Co., Easton, 1, Philadelphia Co., Philadelphia, 3, Westmoreland Co., Jeannette, 1; **New Jersey,** Bergen Co., Fort Lee, 2, Cape May Co., Cape May, 1, Gloucester Co., Wenonah, 2, Mercer Co., Trenton, 1; **Maryland,** Baltimore Co., Sparrow Point, 4, Montgomery Co., Cabin John, 1, Chevy Chase, 1, Plummers Island, 32, Prince Georges Co., College Park, Forestville, 2, St. Marys Co., Leonardtown, 1, Washington Co., Hagerstown, 1; **Washington,** D. C., Rock Creek Park, 8; **Virginia,** Fauquier Co., Paris, 3, Hanover Co., Rockville, 1, Lee Co., Pennington Gap, 1, Straight Creek, 1, Loudoun Co., Bluemont, 1, Nelson Co., 20, Spotsylvania Co., Fredericksburg, 1; **West Virginia,** Monogalia Co., Morgantown, 2; **Kentucky,** Jefferson Co., Louisville, 3; **Ohio,** Richland Co., Butler, 1, Summit Co., Hudson, 2; **Michigan,** Allegan Co., Allegan, 1, Monroe Co., Monroe, 1, Muskegon Co., Lakewood, 4; **Indiana,** Clark Co., 1, Creene Co., Linton, 1, Knox Co., 3, Kosciusko Co., Winona Lake, 1, LaPorte Co., Michigan City, 1, Lawrence Co., Springville, 1, Porter Co., Beverly Shores, 1, Chesterton, 1, Duke Acres, 1, Posey Co., 1; **Illinois,** Champaign Co., Urbana, 5, Cook Co., Willow Springs, 3, Kankakee Co., Blyton, 1, Momence, 1, Roslyn, 1, McLean Co., Bloomington, 4, Heyworth, 1; **Tennessee,** Cumberland Co., Black Mountain, 3, Morgan Co., Burrville, 10; **North Carolina,** Buncombe Co., Black Mountains, 1; **Georgia,** Decatur Co., Spring Creek, 3; **Arkansas,** Washington Co., Springdale, 1; **Oklahoma,** Payne Co., Stillwater, 2; **Kansas,** Douglas Co., Mable Hill, 2, Shawnee Co., Topeka, 1; **Iowa,** Johnson Co., Iowa City, 1; **California,** Shasta Co., Mt. Lassen National Park, 1.

In summary the characteristics of *Parallelostethus attenuatus* are:

1. Sides of mesosternal cavity parallel and horizontal.
2. Apex of elytron strongly acuminate.
3. Dark reddish-brown to black in color; elytra of dark reddish-brown specimens tipped with black.

Genus **DIPLOSTETHUS** Schwarz

Diplostethus Schwarz, 1907, *In* Wytsman, Gen. Ins., fasc. 46, pp. 252, 258.

Type of genus.—*Aphanobius setosus* Germar, 1844, Zeit. Ent., 5: 185. (Designated by Hyslop, 1921, p. 640.) (Location of type: Zool. Mus. Berlin.)

Type locality.—Durango, Mexico.

This genus resembles *Neotrichophorus* generally but differs distinctly in the prosternal process. Genus *Diplostethus* has a ventral tooth immediately behind the procoxae while this structure is absent in *Neotrichophorus*. The sides of the mesosternal cavity are raised into slight or acute tubercles before the middle and not forming sharp ridges as in *Neotrichophorus*.

Description of genus.—Form slightly elongate-oblanceolate, moderately convex, moderately robust, densely umbilicately punctate, clothed with medium, sericeous, oblique setae directed posteriorly. Color reddish brown to dark reddish brown.

Head rounded in front and directed downwards, densely umbilicately punctate; eyes prominent, very slightly protruding. Antennae extending from two-thirds length of pronotum to two segments beyond, antennae moderately serrate, second segment shorter than third, third shorter than fourth, fourth subequal to second and third combined, segment four through ten similar, eleventh slightly longer than tenth, rounded at apex. Mandibles large, very acuminate at apex, left overlapping right, right with pronounced groove; labrum slightly depressed on ventral border, with feeble median longitudinal carina, densely punctate with noticeably long setae laterally directed anteriorly.

Pronotum convex, apex subequal to base, median length shorter than median width, lateral margins slightly converging for one-third of distance from base to apex, then arcuately converging to apex, connecting with anterior border of pronotum; densely, deeply, umbilicately punctate, interstices slightly larger than punctures, surface alutaceous, hind angles broadly and obliquely carinate. Prosternum shiny, coarsely and sparsely punctate, pronotal epipleura dull with smaller, closer punctures. Prosternal process with tooth behind procoxae and horizontally extended to form anteapical tooth. Sides of mesosternal cavity raised, divergent and sloping. Elytra two and one-half times to almost three times as long as broad; elytra striated, striae with hemispherical punctures, surface alutaceous; overall general appearance somewhat rugose; apex conjointly rounded, sutural angle not produced.

Male genitalia with median lobe gradually to abruptly tapering at apex, acutely rounded, deflexed; median struts very short, with expanded chitinized rod; lateral lobes very slightly tapering, slightly constricted apically, apex truncate; with apical and dorso-lateral setae; basal piece with unsclerotized V-shaped area.

Discussion.—These two species are very closely related and possess many morphological characteristics in common. The chief distinguishing characteristic is the form of the declivous portion of the intercoxal process of prosternum. In *Diplostethus peninsularis* this process is sharply toothed as compared with *Diplostethus opacicollis* in which it is more rounded. Schaeffer (1916) mentions that *Diplostethus opacicollis* is related to *Neotrichophorus texanus,* but differs from it in lacking the sudden and perpendicular declivity behind the coxae.

Key to the Species of Diplostethus

1. Prosternal process (Plate XV, Fig. 5) abruptly and perpendicularly declivous just before the middle forming an acute tooth visible in profile ..... *peninsularis*
   Prosternal process (Plate XVI, Fig. 7) abruptly and almost perpendicularly declivous just before the middle, forming a more rounded structure visible in profile ..... *opacicollis*

Diplostethus peninsularis (Champion, 1895)

Ludius peninsularis Champion, 1896, In Biologia, Centrali-Americana Col. Vol. 3(1), p. 507. (Location of type: British Museum (Natural History), London.)

Type locality.—Cape San Lucas, Baja California, Mexico.

This species is distinguished from its close North American relative *Diplostethus opacicollis* in having a more acute tooth on the prosternal process immediately behind the procoxae and in having the sides of the mesosternal cavity raised to form acute points before middle.

Description of species.—Length 18 to 23 mm.; width 5 to 6.5 mm.; body elongate, moderately convex. Antennae extending two-thirds of length of pronotum to two segments beyond.

Prosternal process (Plate XV, Fig. 5) abruptly and perpendicularly declivous just before middle forming an acute tooth when viewed in profile. Sides of mesosternal cavity raised to form acute points before middle. Elytra almost three times as long as broad.

First visible sternite of abdomen with large punctures medio-laterally.

Male genitalia (Plate XVIII, Fig. 6) with sides of median lobe parallel on basal two-thirds, abruptly tapering to acutely rounded, deflexed apex. Lateral lobes less subapically constricted; basal piece with medium unsclerotized sharp V-shaped area.

Distribution.—(Plate XVIII, Map 3.) This species is known from southern California, southern Arizona, northern Mexico (just south of Texas) and from Baja California.

Specimens examined (17).—*United States:* **Arizona,** Pima Co., Bucson, 1, Baboquivari Mountains, 1, Santa Cruz Co., Madera Canyon, Santa Rita Mountains, 1; **California,** Riverside Co., Blythe, 3, Santa Clara Co., San Jose, 6, Sonoma Co., Santa Rosa, 3. *Mexico:* **Baja California,** 2.

Diplostethus opacicollis Schaeffer, 1916

Diplostethus opacicollis Schaeffer, 1916, Jour. New York Ent. Soc., 24(4): 260. (Location of type: United States National Museum, Washington, D. C., type no. 42623.)

Type locality.—Nogales (Nunnenmacher) and Huachuca Mountains, Arizona.

This species is distinguished from *peninsularis* in having a more rounded tooth on the prosternal process immediately behind the procoxae and in having the side of the mesosternal cavity only raised to slight tubercles before middle.

Description of species.—Length 20 to 22 mm.; width 5.5 to 6.5 mm.; body elongate, strongly convex. Antennae approximately as long as pronotum.

Prosternal process (Plate XVI, Fig. 7) abruptly and almost perpendicularly declivous just before the middle, forming a rounded structure if viewed in profile. Sides of mesosternal cavity raised to form slight tubercle before middle. Elytra approximately two and one-half times as long as broad.

First visible sternite of abdomen with moderate punctures medio-laterally.

Male genitalia (Plate XVII, Fig. 7) with median lobe gradually tapering to acutely rounded, deflexed apex; lateral lobes more subapically constricted; basal piece with medium unsclerotized rounded V-shaped area.

Distribution.—(Plate XVIII, Map 3.) This species is known from Texas, southern California and eastern Arizona.

Specimens examined (135).—*United States:* **Texas,** 2, Nacogdoches Co., Douglas, 1; **Arizona,** Cochise Co., Dragoon Mountains, 1, Carr Canyon, 1, Palmerlee, 4, Gila Co., Globe, 2, Graham Co., Ft. Grant, 3, Maricopa Co., Phoenix, Prima Co., Baboquivari Mountains, 27, Molino Canyon, 5, Sabino Canyon, 1, Tucson, 3, Santa Cruz Co., Madera Canyon, Santa Rita Mountains, 18, Peña Blanca, 62, Near Nogales, 4; **California,** Riverside Co., Blythe, 1.

Table 2. Summation of the comparative characters of species of *Diplostethus*.

Diplostethus peninsularis	*Diplostethus opacicollis*
1. Prosternal process abruptly and perpendicularly declivous just before middle, forming an acute tooth if viewed in profile	1. Prosternal process abruptly and almost perpendicularly declivous just before middle, forming a rounded structure if viewed in profile
2. Sides of mesosternal cavity raised to form acute points before middle	2. Sides of mesosternal cavity raised to form slight tubercle
3. Median lobe of male genitalia with sides parallel on basal two-thirds	3. Median lobe of male genitalia with sides tapering
3a. Basal piece with unsclerotized sharp V-shaped area	3a. Basal piece with unsclerotized rounded V-shaped area

Genus **NEOTRICHOPHORUS** Jacobson

Neotrichophorus Jacobson, 1913, Käfer Russeanda, Fasc. 10, p. 742. (Replacement name for *Trichophorus* Mulsant and Godart, 1853, preoccupied.)

Trichophorus Mulsant and Godart, 1853 (not Serville, 1834, or Temminck, 1838), Opuc. Ent., Vol. 2, p. 181.

Type of genus.—*Trichophorus guillebelli* Mulsant and Godart, 1853, l.c. (Monobasic.) (Location of type: Institut. Ste. Marie, Chammond (Loire), France.)

Type locality.—Narbonne, France.

This genus differs from *Elater* in having the metacoxal plates rounded on the inner third and the sides of the mesosternal cavity elevated to form sharp ridges. It differs from *Diplostethus* in having a single anteapical tooth on the prosternal process rather than being doubly toothed.

Description of genus.—Length 12–23 mm., width 3.5–7 mm. Form elongate, slender to moderately robust; light reddish brown to dark reddish brown in color, clothed with yellowish pubescence. Eyes prominent, not protruding to slightly protruding; antennae extending three-fourths of length of pronotum to approximately two segments beyond, second segment shorter than third, second and third combined shorter than fourth. Segments four through ten similar, eleventh longer than tenth and constricted apically resembling pseudo-twelfth. Mandibles large, entire.

Median length of pronotum slightly shorter to slightly longer than width, posterior angles of pronotum carinated, slightly divergent, lateral margins slightly sinuate, distinct, continuous to anterior border; pronotum strongly

convex, moderately to densely, deeply, umbilicately punctate, punctures larger than interstices to smaller than interstices, surface alutaceous, posterior margin of pronotum entire; pronotal epipleura sparsely to densely punctate. Prosternum with large suberect setae subapically; prosternal lobe broadly rounded apically; prosternal process with single sub-apical tooth. Mesosternum sparsely punctate, sparsely clothed with fine setae to densely punctate, densely clothed with large setae. Sides of mesosternal cavity raised into a sharp ridge. Metasternum sparsely punctate, sparsely clothed to moderately punctate, moderately clothed with medium setae. Elytra elongate, apex slightly to moderately tapering, conjointly rounded, sutural angles not produced; weakly to distinctly striated, clothed with fine to medium yellowish pubescence. Metacoxal plates rounded on inner third.

Abdomen sparsely punctate, sparsely clothed to moderately punctate, moderately clothed with medium to fine setae, becoming abruptly more densely punctate, more densely clothed on fifth abdominal sternite.

Male genitalia short, slender, to long, stout; median lobe abruptly tapering apically, apex acute to acutely rounded, deflexed; median struts short, auriculate, chitinized rod prominently expanded, fusiform; lateral lobes scarcely to slightly tapering, truncate, broadly rounded apically, ventrolaterally subapically fringed with long recurved setae; basal piece with slightly to heavily chitinized borders and mid line; unsclerotized area small to moderate U-shaped.

Discussion.—This genus is represented by five species in North America. It is very homogeneous, having clear strong generic characters which facilitate rapid separation from other genera in the tribe Elaterini. The specific characters, however, are not as clearly defined. The characters used for separating the species are sometimes in the form of comparative degrees of common characteristics. I realize the difficulty one might encounter in attempting to identify a single specimen only, and have tried to resolve the difficulty by including in the descriptions adequate information for recognition and identification. The raised sharp ridge on either side of the mesosternal cavity, the metacoxal plates rounded on inner third, and the characteristic shape of the prosternal process are generically diagnostic. The shape of the prosternal process which has a single subapical tooth separates this genus from the closely related genus *Diplostethus*. The prosternal process in *Diplostethus* drops sharply immediately behind the procoxal cavities giving the appearance of a second tooth or projection anterior to the subapical tooth. The close relationship between these two genera is indicated in their similar general appearance—the shape of the metacoxal plates, the ridged sides of the mesosternal cavity, and the structure of the genitalia.

Key to the Species of Neotrichophorus

1. Robust, median width of pronotum slightly longer than median length 2
   Slender, median length of pronotum slightly longer than median width 3
2. Moderately stout, prothorax gradually tapering apically, sides parallel on basal third (Plate XVI, Fig. 8), less quadrate ..... *texanus*
   Less stout, prothorax slightly tapering apically, sides parallel on basal two-thirds (Plate XVI, Fig. 9), almost quadrate ..... *carolinensis*
3. Elytra feebly striated (Plate XVI, Fig. 10), pronotal epipleura densely punctate ..... *substriatus*
   Elytra distinctly striated, pronotal epipleura sparsely to densely punctate 4
4. Pronotal epipleura densely punctate; abdominal sternites with numerous large punctures medio-laterally (Plate XVI, Fig. 11) .... *arizonensis*
   Pronotal epipleura sparsely punctate; abdominal sternites with few, much smaller punctures laterally (Plate XVI, Fig. 12) ..... *variatus*

Neotrichophorus texanus LeConte, 1853

Neotrichophorus texanus (LeConte, 1853), Rev. Elat. United States. Trans. American Phil. Soc., 10: 454. (Location of type: Museum of Comparative Zoology, Cambridge, Massachusetts, type no. 2487.)

Type locality.—Eagle Pass, on Rio Grande, Texas.

The median length of pronotum is slightly shorter than the median width; prothorax is somewhat quadrate, the sides are parallel on basal third. This species differs from *Neotrichophorus carolinensis* in being more robust and having shorter antennae.

Description of species.—Length 19–23 mm.; width 5.5–7 mm. Body elongate, moderately robust, dark reddish brown in color, clothed with dense yellowish pubescence. Eyes slightly protruding; antennae extending three-fourths of length of pronotum in females, longer than pronotum in males.

Median width of pronotum (Plate XVI, Fig. 8) slightly longer than median length, very convex; lateral margins gradually tapering apically. Mesosternum densely pubescent, clothed with large, long setae. Metathorax sparsely punctate, sparsely clothed with medium setae. Elytra slightly over two times as long as wide, distinctly striated, conjointly rounded at apex, sutural angle not prolonged.

Abdomen sparsely punctate, clothed with fine setae in middle, larger laterally.

Male genitalia (Plate XVII, Fig. 8) long, somewhat stout, median lobe tapering abruptly apically, basal two-thirds subparallel, apex acute, deflexed, chitinized rod prominent, expanded, fusiform; lateral lobes slightly tapering, rounded apically, slightly constricted subapically; ventro-laterally subapically fringed with long recurved setae; basal piece with medium rounded U-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 4.) This species is known from Texas, Arizona and California.

Specimens examined (39).—*United States:* **Texas,** Bexar Co., San Antonio, 5, Blanco Co., Round Mountain, 3, Brewster Co., Alpine, 3, Chisos Mountains, 1, Cameron Co., Brownsville, 6, Colorado Co., Columbus, 3, Comal Co., New Braunfels, 4, Dallas Co., Dallas, 1, Goliad Co., Goliad State Park, 1, Jeff Davis Co., Fort Davis, 4, Jefferson Co., Sabine Pass, 1, Uvalde Co., Uvalde, 2; **Arizona,** Maricopa Co., Phoenix, 1, Pima Co., Tucson, 1, Santa Cruz Co., Patagonia, 2; **California,** Santa Calar Co., San Jose, 1.

Neotrichophorus carolinensis Schaeffer, 1916

Neotrichophorus carolinensis Schaeffer, 1916, Journ. New York Ent. Soc., 24(4): 261. (Location of type: United States National Museum, Washington, D. C., type no. 42622.)

Type locality.—Southern Pines, North Carolina.

The median length of the pronotum is slightly shorter than the median width; the prothorax is almost quadrate, the sides are nearly parallel on the basal two-thirds. Schaeffer (1917) stated that *Neotrichophorus carolinensis* is very close to *Neotrichophorus texanus.* This species differs from *Neotrichophorus texanus* in having a more quadrate prothorax, longer antennae, and slender body form.

Description of species.—Length 14–20 mm.; width 4.5–5 mm. Body elongate, slightly to moderately robust, light reddish brown in color, clothed with dense yellowish pubescence. Eyes not protruding, follow contour of head. Antennae longer than pronotum.

Median width of pronotum (Plate XVI, Fig. 9) slightly longer than median length, lateral margins slightly tapering apically, parallel on basal two-thirds, almost quadrate. Elytra elongate, almost two and one-half times as long as wide, distinctly striated, conjointly rounded at apex, sutural angle not prolonged. Mesosternum moderately punctate, moderately clothed with long, medium setae. Metasternum sparsely punctate, sparsely clothed with medium setae.

Abdomen moderately punctate, clothed with medium setae.

Male genitalia (Plate XVII, Fig. 9) long, stout; lateral lobes not perceptibly tapering, truncate, broadly rounded apically; basal piece with heavy chitinized borders and basal piece with medium U-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 4.) This species is known from southeastern United States from Virginia southward to Florida and westward to Texas.

Specimens examined (116).—*United States:* **Virginia,** Roanoke Co., Roanoke, 1; **North Carolina,** Dare Co., Roanoke Is., 1, Kill Devil Hills, 1, Moore Co., Southern Pines, 6; **Georgia,** Chatham Co., Savannah, 2; **Florida,** Bradford Co., Starke, 1, Columbia Co., Lake City, 1, Dade Co., Biscayne, 1, Homestead, 1, Hernando Co., Brooksville, 1, Highlands Co., Lake Placid, 2, Archibold Biological Station, 5, Hillsborough Co., Tampa, 3, Levy Co., Cedar Keys, 2, Palm Beach Co., Lake Worth, 4, Jupiter, 2, Putnam Co., Crescent City, 3, Sarasota Co., Englewood, 2, Volusia Co., Enterprise, 8; **Alabama,** Geneva Co., Coffee Springs, 1, Mobile Co., Mobile, 4; **Mississippi,** George Co., Lucedale, 12, Harrison Co., Gulfport, 23, Perry Co., New Augusta, 3; **Arkansas,** Hempstead Co., Hope, 10; **Louisiana,** Orleans Co., New Orleans, 5; **Texas,** Austin Co., St. Augustine State Park (Near Sealy), 1, Bastrop Co., Bastrop, 2, Bexar Co., San Antonio, 3, Bosque Co., Meridian State Park, 1, Brazos Co., College Station, 1, Brewster Co., Alpine, 1, San Patricio Co., Lake Corpus Christi, 2.

Neotrichophorus substriatus Schaeffer, 1916

Neotrichophorus substriatus Schaeffer, 1916, Journ. New York Ent. Soc., 24(4): 261. (Location of type: United States National Museum, Washington, D. C., type no. 54321.)

Type locality.—Arizona. (Not restricted further.)

The size and general shape of this species indicate a relationship to *Neotrichophorus arizonensis* and *Neotrichophorus variatus*. Schaeffer (1917) stated that this species is readily distinguished from other species of *Neotrichophorus* by its feebly impressed and partially obliterated elytral striae and shorter antennae.

Description of species.—Length 13–15 mm.; width 3.5–4 mm. Body elongate, slender, light reddish brown in color, clothed with dense yellowish pubescence. Eyes slightly protruding; antennae as long as pronotum.

Median length of pronotum slightly longer than median width, lateral margins scarcely tapering apically, sides parallel on basal third. Mesosternum moderately punctate, clothed with long, fine setae. Metasternum sparsely punctate, sparsely clothed with medium setae. Elytra (Plate XVI, Fig. 10) elongate, over two and one-half times as long as broad, weakly striated, conjointly rounded at apex, sutural angle not prolonged.

Abdomen sparsely punctate, sparsely clothed with medium setae.

Male genitalia (Plate XVII, Fig. 10) short, slender; median lobe gradually then abruptly tapering apically; apex acutely rounded, defiexed, chitinized rod prominent, expanded, fusiform; lateral lobes slightly tapering, rounded apically, slightly constricted subapically, ventral edge of lateral lobes slightly indented, ventro-laterally subapically fringed with long recurved setae; basal piece with shallow U-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 4.) This species is known from Texas and Arizona.

Specimens examined (6).—*United States:* **Texas,** Kleberg Co., Kingsville, 1, Uvalde Co., Uvalde, 1; **Arizona,** Gila Co., Globe, 3, Navajo Co., Keyenta, 1.

Neotrichophorus arizonensis Schaeffer, 1916

Neotrichophorus arizonensis Schaeffer, 1916, Journ. New York Ent. Soc., 24(4): 262. (Location of type: United States National Museum, Washington, D. C., type no. 42620.)

Type locality.—Santa Rita Mountains, Arizona.

The median length of the pronotum slightly longer than the median width; the elytra distinctly striated; the abdomen with numerous large punctures medio-laterally. It differs from *Neotrichophorus substriatus* in being narrower and having longer antennae.

Description of species.—Length 12–14.5 mm.; width 3.75–4.25 mm. Body elongate, slender, light reddish brown in color, clothed with yellowish pubescence. Eyes not protruding, follow contour of head; antennae longer than pronotum.

Median length of pronotum slightly longer than the median width; lateral margins slightly tapering apically, parallel on basal third. Mesosternum moderately punctate, moderately clothed with fine setae. Metasternum moderately punctate, moderately clothed with medium setae. Elytra elongate, almost two and one-half (2.4) times as long as wide, distinctly striated, conjointly rounded at apex, sutural angle not prolonged.

Abdomen (Plate XVI, Fig. 11) with numerous large punctures medio-laterally on first through fourth visible sternite.

Male genitalia (Plate XVII, Fig. 11) short, slender, median lobe gradually, then abruptly tapering apically, apex acute, deflexed; chitinized rod prominent, expanded, fusiform; lateral lobes scarcely tapering, rounded apically, slightly constricted subapically, ventral edges of lateral lobes slightly indented, basal piece with moderate U-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 4.) This species is known from Texas, New Mexico and Arizona.

Specimens examined (101.—*United States:* **Texas,** Duval Co., San Diego, 3, Jeff Davis Co., Valentine, 1; **New Mexico,** Dona Ana Co., Las Cruces, 1, Quay Co., San Jon, 2; **Arizona,** Cochise Co., Paradise, 6, Gila Co., Globe, 8, Pinal Mountains, 1, Graham Co., Fort Grant, 15, Metcalf, 1, Pima Co., Baboquivari Mountains, 7, Kits Peak Rincon, 1, Molino Canyon, 7, Organ Pipe, 1, Near Sabino, 18, Pinal Col., Oracle, 8, Magma, 1, Santa Cruz Co., Pena Blanca, 18, Greenlee Co., Pinaleno Mountains, 1, Coconino Co., Badger, 1.

Neotrichophorus variatus Schaeffer, 1916

Neotrichophorus variatus Schaeffer, 1916, Journ. New York Ent. Soc., 24(4): 262. (Location of type: United States National Museum, Washington, D. C., type no. 42621.)

Type locality.—Brownsville, Texas.

The median length of the pronotum slightly longer than the median width; elytra distinctly striated; abdomen with numerous small punctures laterally. It differs from *Neotrichophorus substriatus* in having distinct elytral striae and longer antennae and from *Neotrichophorus arizonensis* in being a little broader and in having the pronotal epipleura less closely punctate.

Description of species.—Length 13–15 mm.; width 4–4.3 mm. Body elongate, slender, light reddish brown in color, clothed with yellowish pubescence. Eyes prominent, protruding slightly; antennae longer than pronotum.

Median length of pronotum slightly longer than median width, lateral margins tapering slightly apically. Mesosternum moderately punctate, moderately clothed with fine setae. Metasternum moderately punctate, moderately clothed with medium setae. Elytra elongate, almost two and one-half times as long as wide, distinctly striated, conjointly rounded at apex, sutural angle not prolonged.

Abdomen (Plate XVI, Fig. 12) moderately punctate, moderately clothed with medium setae.

Male genitalia (Plate XVII, Fig. 12) short, slender; median lobe gradually then abruptly tapering apically, apex acutely rounded, deflexed, chitinized rod prominent, expanded, fusiform; lateral lobes slightly tapering, rounded apically, slightly constricted subapically; ventral edges of lateral lobes slightly indented, ventro-laterally subapically fringed with long recurved setae, basal piece with shallow U-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 4.) This species is known from southern Texas.

Specimens examined (56).—*United States:* **Texas,** Brewster Co., Alpine, 22, Brooks Co., Falfurrias, 1, Brown Co., Brownwood, 1, Cameron Co., Brownsville, 8, Culberson Co., Van Horn, 1, Duval Co., San Diego, 3, Hudspeth Co., Esperanza Ranch, 11, Sierra Blanca, 2, Jeff Davis Co., Valentine, 1, Fort Davis, 1, Kleberg Co., Kingsville, 5.

Table 3. Summation of comparative characteristics of species of *Neotrichophorus*.

Neotrichophorus texanus	*Neotrichophorus carolinensis*	*Neotrichophorus substriatus*
1a. Size—length 19–23 mm.; width, 5.5–7 mm.	1a. Size—length, 14–20 mm.; width, 4–5.5 mm.	1a. Size—length, 13–17 mm.; width, 3.5–4.5 mm.
1b. Color—dark reddish brown	1b. Color—light reddish brown	1b. Color—light reddish brown
2. Eyes—slightly protruding	2. Eyes not protruding, follow contour of head	2. Eyes slightly protruding
3. Pronotum—convex, gradually tapering, median length subequal to median width	3. Pronotum—convex, almost quadrate, median length subequal to median width	3. Pronotum—convex, gradually tapering, median width subequal to median length
4. Metasternum sparsely punctate, sparsely clothed with medium setae	4. Metasternum sparsely punctate, sparsely clothed with medium setae	4. Metasternum moderately punctate,, moderately clothed with medium setae
5. Elytra slightly over two times as long as broad, striated	5. Elytra almost two and one-half times as long as wide, striated	5. Elytra slightly over two and one-half times as long as wide, feebly impressed striae
6. Abdomen sparsely clothed with medium setae	6. Abdomen moderately clothed with medium setae	6. Abdomen sparsely clothed with medium setae
7. Male genitalia long, stout, basal piece with broad U-shaped unsclerotized area	7. Male genitalia long, stout, basal piece with rounded U-shaped unsclerotized area	7. Male genitalia short, moderately slender, basal piece with shallow U-shaped unsclerotized area

Table 3, continued.

Neotrichophorus arizonensis	*Neotrichophorus variatus*
1a. Size—length, 12–14.5 mm.; width, 3.75–4.75 mm.	1a. Size—length, 13–15.5 mm.; width, 4–4.3 mm.
1b. Color—light reddish brown	1b. Color—light reddish brown
2. Eyes not protruding follow contour of head	2. Eyes slightly protruding
3. Pronotum convex, gradually tapering, median width subequal to median length	3. Pronotum convex, gradually tapering, median width subequal to median length
4. Metasternum moderately punctate, moderately clothed with medium setae	4. Metasternum moderately punctate, moderately clothed with medium setae
5. Elytra two and one-half times as long as wide, distinctly striated	5. Elytra almost two and one-half times as long as wide, distinctly striated
6. Abdomen moderately clothed with fine setae and with large punctures medio-laterally on first through fourth visible sternites	6. Abdomen moderately clothed with medium setae and with moderate punctures medio-laterally on first through fourth visible sternites
7. Male genitalia short, moderately slender, basal piece with moderate U-shaped unsclerotized area	7. Male genitalia short, slender, basal piece with shallow U-shaped unsclerotized area

Genus **ORTHOSTETHUS** Lacordaire

Orthostethus Lacordaire, 1857, Gen. Col., Vol. 4, p. 207.

Type of genus.—*Aphanobius infuscatus* Germar, 1844, Zeit. Ent., 5: 183. (Original designation.) (Type located Zool. Mus., Berlin.)

Type locality.—"Boreal America." (Not restricted further.)

The members of this genus are very elongate; the sides of mesosternal cavity declivous, and the prosternal process is straight. These characteristics will readily separate this genus from all others of the Elaterini. Color ranges from dark brown to black.

Description of genus.—Form very elongate, very robust, moderately convex; ventral surface sparsely to moderately punctate, punctures and setae large and sparse on prosternum, gradually becoming smaller and dense on thorax and abdomen. Eyes prominent, slightly protruding, antennae moderately serrate to deeply serrate, male antennae generally more deeply serrate; antennae extending two-thirds of length of pronotum to one segment longer than pronotum; mandibles moderate and simple.

Median length of pronotum subequal to or longer than median width, lateral margins weakly explanate to moderately explanate, slightly visible

to clearly visible in dorsal view. Posterior angles carinate; posterior border entire. Pronotal punctures small and deep, interstices three to four times larger than punctures, surface alutaceous. Prosternum convex; prosternal process almost straight with anteapical projection; prosternal sutures large, convex. Sides of mesosternal cavity declivous. Elytra elongate, moderately to densely clothed with yellowish pubescence.

Genitalia short and stout to slender and moderately robust; median lobe with apex acutely pointed, deflexed, chitinized rod prominent, lateral lobes with acute apex, moderately arcuate, slightly expanded subapically or not expanded with large dorso-lateral setae. Basal piece with large unsclerotized rounded U-shaped area.

Discussion.—Genus *Orthostethus* is represented in North America by two species, *Orthostethus infuscatus* and *Orthostethus caviceps*. The chief diagnostic character of this genus is the marked declivity of the sides of the mesosternal cavity. The straightness of the prosternal process is also distinctive.

Key to the Species of Orthostethus

1. Antennae longer than pronotum; apex of elytra broadly rounded, sutural angles very slightly prolonged; sides of mesosternal cavity (Plate XVI, Fig. 13) divergent and moderately declivous anteriorly *caviceps*

   Antennae shorter than pronotum; apex of elytron slightly acuminate and directed obliquely; sides of mesosternal cavity (Plate XVI, Fig. 14) divergent and suddenly declivous anteriorly ..... *infuscatus*

Orthostethus caviceps Schaeffer, 1916

Orthostethus caviceps Schaeffer, 1916, Jour. New York Ent. Soc., 24(4): 263. (Location of type: United States National Museum, Washington, D. C., type no. 42624.)

Type locality.—Huachuca Mountains, Arizona.

This species differs from *Orthostethus infuscatus* in having the antennae longer than pronotum, the apex of the elytra broadly rounded and the sides of the mesosternal cavity moderately declivous.

Description of species.—Length 24 to 33 mm.; width 6.5 to 9 mm.; body elongate, very robust, moderately convex, dark reddish brown in color, moderately clothed with small yellowish setae, posteriorly directed, pattern fairly uniform.

Head sparsely umbilicately punctate, interstices slightly larger than punctures; head slightly depressed behind frontal margin. Antennae extending

one segment beyond pronotum, second segment beaded, subequal to third, third slightly serrate, segments two and three combined shorter than fourth.

Median length of pronotum longer than median width, widest at posterior angles; lateral margins slightly explanate, slightly visible in dorsal view, becomes evanescent immediately before reaching anterior border, very feeble on posterior angles. Posterior angles carinate; sides of mesosternal cavity (Plate XVI, Fig. 13) moderately declivous before middle. Elytra more than 2.5 times longer than wide, slightly broadly rounded, sutural angles very slightly prolonged. Elytra punctate, sparsely clothed with fine yellowish hairs; interstices larger than punctures, surface moderately alutaceous; overall appearance rugose. First segment of tarsi slightly longer than fifth.

Male genitalia (Plate XVII, Fig. 13) short, stout; slightly acuminate at apex, deflexed. Lateral lobes subapically expanded, with very long dorsolateral setae, apices moderately arcuate medianly.

Distribution.—(Plate XVIII, Map 5.) This species is known from southeastern Arizona.

Specimens examined (56).—*United States:* **Arizona,** Cochise Co., Huachuca Mountains, 20, Palmerlee, 5, Paradise, 4, San Bernardino Ranch, 2, Santa Cruz Co., Madera Canyon, Santa Rita Mountains, 25.

Orthostethus infuscatus (Germar, 1844)

Aphanobius infuscatus Germar, 1844, Zeit. Ent., 5: 183. (Location of type: Zool. Mus., Berlin.)

Type locality.—"Boreal America." (Not restricted further.)

Orthostethus praefectus Candèze, 1863, Mon. Elat., Vol. 4, p. 315. Placed as synonym of *Orthostethus infuscatus* (Germar, 1844), Champion, 1896. Biologia Centrali-Americana, Vol. 3(1), p. 508.[5]

Type locality.—Brazil (Not restricted further.)

Pristilophus sordidus Melsheimeir, 1845, Proc. Acad. Nat. Sci. Philadelphia, 2: 216. Placed as synonym of *Orthostethus infuscatus* (Germar, 1844), LeConte, 1853. Rev. Elat. United States, Trans. American Phil. Soc., 10: 493.

Type locality.—Alabama. (Not restricted further.)

This species differs from *Orthostethus caviceps* in having the antennae shorter than the pronotum, the apex of elytron slightly acuminate, and sides of mesosternal cavity suddenly declivous.

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[5] Note: Champion, 1896, stated that he had four specimens, three determined by Candèze himself, and the species was based upon a large female. The Brazilian examples are inseparable from others of the same size and sex from North America. The thorax is as long as broad in both sexes, with the sides subparallel in the male, and more rounded anteriorly in the female.

Description of species.—Length 28 to 35 mm.; width 7 to 9.5 mm.; body very elongate, moderately convex, very robust, very densely clothed with medium yellowish posteriorly directed setae, pattern fairly uniform.

Head directed downwards, sparsely umbilicately punctate, interstices larger than punctures; head slightly depressed behind frontal margin. Antennae extending four-fifths of the length of pronotum in males, two-thirds in females; second segment shorter than third, third shorter than fourth, second to third combined subequal to fourth; segment four through ten similar, eleventh longer than tenth, constricted apically.

Median length of pronotum slightly longer than median width; lateral margins clearly moderately explanate, clearly visible in dorsal view from posterior angles to anterior border; posterior angles carinate, sides of mesosternal cavity (Plate XVI, Fig. 14) abruptly declivous before middle. Elytra more than 2.5 times longer than width, moderately tapering; apex of elytron slightly acuminate and directed obliquely. Elytra densely punctate, densely clothed with medium yellowish setae; striae obsolete, interstices twice as large as punctures; surface weakly alutaceous; overall appearance rugose. First segment of tarsi subequal to fifth.

Male genitalia (Plate XVII, Fig. 14) slender, moderately robust, acuminate at apex, deflexed, lateral lobes not expanded subapically with very long dorso-lateral setae, apices slightly arcuate medianly.

Distribution.—(Plate XVIII, Map 5.) This species is recorded from southeastern United States from Maryland southward to Florida and westward to Texas and Arizona.

Specimens examined (95).—*United States:* **Maryland,** Saint Marys Co., Piney Point, 1; **Virginia,** Nelson, Co., 1; **North Carolina,** Granville Co., Oxford, 1, Moore Co., Southern Pines, 2, Polk Co., Tryon, 2; **South Carolina,** 2; **Georgia,** Chatham Co., Savannah, 3, Macon Co., Highlands, 4, Monroe Co., 1, Morehead Co., 1, Ware Co., Okefenokee Swamp, 1; **Florida,** Alachua Co., Archer, 1, The Glen, Micanopy, 1, Dade Co., Miami, 1, Hardee Co., Zolfo Springs, 1, Hendry Co., LaBelle, 3, Hernando Co., Brooksville, 2, Putnam Co., Crescent City, 2, Saint Johns Co., Hastings, 1, Volusia Co., De Land, 1, Enterprise, 10; **Alabama,** Mobile Co., Dauphin, 5, Grand Bay, 1, Mobile, 3, Spring Hill, 2, Morgan Co., Pryor Springs, Decatur, 1, Colbert Co., Wilson Dam, 3; **Mississippi,** George Co., Lucedale, 1, Grenada Co., Grenada, 1, Harrison Co., Biloxi, 2; **Ohio,** Hamilton Co., Cincinnati, 1; **Tennessee,** Davidson Co., Nashville, 2, Morgan Co., Burrville, 3, Smith Co., Elmwood, 2; **Louisiana,** Bienville Co., Ringgold, 1, East Carroll Co., Lake Providence, 1, Orleans Co., New Orleans, 1; **Arkansas,** Hempstead Co., Hope, 2, Lawrence Co., Imboden, 3; **Missouri,** St. Louis Co., 4; **Kansas,** Sedgwick Co., Wichita, 1; **Texas,** Burnet Co., 1, Colorado Co., Columbus, 3, Comal Co., 3, Kerr Co., Kerrville, 1, Kleberg Co., Kingsville, 2, Victoria Co., Victoria, 1; **Arizona,** Santa Cruz Co., Madera Canyon, Santa Rita Mountains, 2.

Table 4. Summation of the comparative characters of species of *Orthostethus*.

Orthostethus caviceps	*Orthostethus infuscatus*
1a. Form elongate, slightly tapering	1a. Form elongate, gradually tapering
1b. Size—moderately large	1b. Size—large
2. Antennae—longer than pronotum, segment two beaded, subequal to third, second and third combined shorter than fourth	2. Antennae—shorter than pronotum, segment two shorter than third, second and third combined subequal to fourth
3. Median length of pronotum longer than median width	3. Median width of pronotum subequal to median length
4. Sides of mesosternal cavity moderately declivous	4. Sides of mesosternal cavity abruptly declivous
5. Elytron apex rounded, sutural angle slightly prolonged	5. Elytron apex slightly acuminate
6. Male genitalia—short, stout, lateral lobes expanded subapically	6. Male genitalia—slender, moderately robust, lateral lobes not expanded subapically

Genus **SERICUS** Eschscholtz

Sericus Eschscholtz, 1829, in Thon, Ent. Archiv., Vol. 2, pt. 1, p. 34.

Type of genus.—Elater brunneus Linnaeus, 1758. Syst. Nat., 10th ed., 1, p. 404. (= *Sericosomus* Dejean, 1833, Dejean Cat. Col., 3d. 2, p. 96.)
Type locality.—Europe. (Not restricted further.)

Sericosomus Dejean, 1833, Dejean Cat. Col., ed. 2, p. 96.

Type of genus.—Elater brunneus Linnaeus, 1758, Syst. Nat. 10th ed., (1), p. 404. (Designated by Westwood, 1840, p. 25 of appendix.) (= *Sericus* Eschscholtz, 1829, in Thon, Ent. Archiv., Vol. 2(1), p. 34.)
Type locality.—Europe. (Not restricted further.)

Atractopterus LeConte, 1853, Trans. American Philos. Soc., 10: 422, 454, 505. Placed as synonym of *Sericosomus* Dejean, 1833, Candèze, E. C., 1863, Mon. Elat., Vol. 4, p. 427.

Type of genus.—Atractopterus fusiformis LeConte, 1853, Trans. American Philos. Soc., 10: p. 454. (Designated by Hyslop, 1921, p. 630.)
Type locality.—Lake Superior. (Not restricted further.)

Dolerosomus Motschulsky, 1859, Bull. Moscou, IV, p. 32. Placed as a synonym of *Sericosomus* Dejean, 1833, Candèze, E. C., 1863, Mon. Elat., Vol. 4, p. 427.

Type of genus.—Dolerosomus flavipennis Motschulsky, 1859, Bull. Moscou, 32(4): 383. (Designated by Hyslop, 1921, p. 641.)
Type locality.—Cape Drake, Northern California.

The antennae are generally serrate, sometimes filiform, the prosternal sutures are excavated in front, and the metacoxal plates are nearly the same width throughout and not toothed as in *Elater*. The elytra are deeply and coarsely striated.

Description of genus.—Form small, elongate, moderately convex, head rounded in front, mouth directed downwards; eyes prominent, not protruding to slightly protruding. Color ranges from light brownish yellow to dark reddish brown or black, generally pronotum characteristically darker than elytra. Mandibles and ventral surface of body darker than dorsal surface, legs lighter. Antennae slightly serrate or filiform, extending three-fourths of length of pronotum to beyond one-third the length of elytra, fourth segment to tenth similar, eleventh longer than tenth; mandibles cleft at apex, dorsal lobe shorter than ventral lobe, apex acute.

Median length of pronotum from subequal to median width to slightly longer than median width; lateral margins of pronotum straight and visible in dorsal view, slightly sinuate or not sinuate, converging slightly anteriorly. Prosternal lobe short, broadly rounded to moderately long, more acutely rounded; sides of mesosternal cavity moderate, slightly divergent. Metacoxal plates with posterior margins slightly to gradually dilated inwardly. First tarsal segment shorter than fifth. Elytra elongate, deeply striated with punctate striae, intervals slightly raised, striae three or more times broader than intervals.

Abdomen with or without lateral depressions.

Median lobe of male genitalia long, tapering, to acute deflexed apex; median struts slight to very long and pronounced, chitinized rod short to long; lateral lobes tapering, expanded, or slightly hooked apically; basal piece short, very broad to long, slender; unsclerotized area very small to moderately large.

Discussion.—The Junk-Schenkling Catalogue (1927) recognizes in the species *Sericus silaceus* the variety, *Sericus silaceus debilis* LeConte, 1859. LeConte, 1859, erected the species, *Sericus debilis*, on the following characteristics and from the examination of one specimen. He stated that *Sericus debilis* is "closely related to *Sericus silaceus* and differs essentially only by the posterior angles of the thorax not diverging, but continuing the outline of the thorax." Presently I consider this insufficient basis for species differentiation. The type specimens of each of these has been carefully studied and compared. The chief differences between them were size and color of pronotum. Realizing the possible variation in these characteristics in a given species I hesitate to separate them on what I consider relatively feeble and variable characteristics. The present study includes *Sericus*

debilis LeConte, 1859, in the species *Sericus silaceus* (Say, 1825). It should be noted that this study recognizes a complex within the silaceus-group from the aforementioned variations, but in the absence of what I consider sufficient biological, ecological, and distributional data the difficulty cannot be resolved presently.

When Van Dyke (1932) was describing *Agriotes blaisdelli*, he was not certain of its taxonomic position. He indicated that it is closely related to *Dalopius*. Becker (1956) assigned this species to *Sericus* or near to this species. I have examined two paratypes and many other individuals of this species, and feel that while it bears certain superficial resemblance to the *Sericus* species it differs sufficiently to be excluded from this genus in the present study. This is true especially of the structure of the male genitalia which differs markedly from the *Sericus* species and also in the finer and sparser elytral striation. The present study, therefore, recognizes four North American species of *Sericus* which constitute a somewhat diverse group. While this genus is not as homogeneous as *Neotrichophorus* and *Diplostethus* a gradient in variation of morphological characteristics indicates relationship among the species.

Key to the Species of Sericus [6]

1. Pronotum with two circular lateral depressions (Plate XVI, Fig. 15) on anterior third ..... *viridanus*
   Pronotum without depressions 2
2. Median length of pronotum (Plate XVI, Fig. 16) slightly shorter than median width; punctures moderate (Plate XVI, Fig. 17), interstices approximately twice the size of punctures ..... *honestus*
   Median width of pronotum slightly shorter than median length; punctures large, interstices equal to or less than the size of the punctures 3
3. Median width of pronotum (Plate XVI, Fig. 18) slightly shorter than median length; punctures large (Plate XVI, Fig. 19), interstices approximately equal to size of punctures ..... *incongruus*
   Median length of pronotum (Plate XVI, Fig. 20) noticeably longer than median width; punctures large (Plate XVI, Fig. 21), interstices small, almost eliminated ..... *silaceus*

[6] *Sericus basalis* Motsch, 1859, *Sericus humeralis* Motsch, 1859, listed in the Junk-Schenkling Catalogue, 1927, supposedly from California, are unknown to me.

Sericus viridanus (Say, 1825)

Elater viridanus Say, 1825, Ann. Lyc. Nat. Hist. New York, 1: 250.

Type locality.—Pennsylvania. (Not restricted further.)

Elater sublucens Randall, 1838, Boston Jour., II, p. 37. Placed as synonym of *Sericus viridanus* (Say, 1825), LeConte, J. L., 1853. Trans. American Phil. Soc., 10: 454.

Type locality.—Cambridge, Massachusetts.

This species differs from all other species of *Sericus* in having two circular lateral depressions on the anterior third of the pronotum. Dietrich (1945) pointed out that its iridescent color is also distinctive of this species.

Description of species.—Length 8–11 mm.; width 2.5–3 mm. Body elongate, moderately convex, color ranges from light yellowish brown to dark yellowish brown. Legs, basal segment of antennae, posterior angles and ventral surface lighter than dorsal surface, clothed with yellowish pubescence. Eyes prominent, moderately protruding; antennae slightly shorter than pronotum, serrate, second segment larger in diameter than third, but shorter; third segment long, but shorter than fourth, fourth through tenth similar, eleventh apically rounded.

Median length of pronotum (Plate XVI, Fig. 15) longer than median width, with two characteristically deeply indented lateral depressions on apical third; posterior angles carinate, lateral margins slightly sinuate anterior to posterior angles, slightly converging anteriorly, moderately punctate with large, umbilicate punctures; punctures and interstices approximately equal in size; clothed with medium yellowish pubescence, with median longitudinal feebly impressed lines on basal third. Elytra elongate, gradually tapering; apex of elytron acute. Elytra over two and one-half times longer than broad, distinctly deeply punctate striae, intervals slightly raised, moderately clothed with medium yellowish pubescence.

Male genitalia (Plate XVII, Fig. 15) with median lobe laterally compressed on apical third, apex strongly deflexed, median struts very long; chitinized rod short; lateral lobes with expanded shoulders, also laterally compressed on apical third, rounded apically, shoulders slightly hooked, setae subapical on external surfaces; basal piece twice as long dorsally as ventrally, and seems to fit over lateral lobes, shallow U-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 6.) This species is known from northeastern United States, and is recorded from New York to Virginia and also from Michigan.

Specimens examined (49).—*United States:* **New York**, Essex Co., Crown Point, 2, Far Rockaway Co., Rockaway Beach, 1, Orange Co., West Point,

5, Tompkins Co., Ithaca, 1, Ulster Co., Oliverea, 1, Westchester Co., Katonah, 2, Peekskill, 2; **Michigan,** Washtenaw Co., Ann Arbor, 2; **New Jersey,** 3, Atlantic Co., Decosta, 1, Hudson Co., Greenwood Lake, 1, Mercer Co., Trenton, 1; **Pennsylvania,** Centre Co., State College, 10; **Maryland,** So. Mountains near Meyersville, 3, Harford Co., Edgewood, 2, Prince Georges Co., Branchville, 1, Washington Co., Hagerstown, 1; **District of Columbia,** Rock Creek Park, 9; **Virginia,** Fairfax Co., Glencarlyn, 1.

Sericus honestus Randall, 1838

Elater honestus (Randall, 1838), Boston Jour. Nat. Hist., II, p. 9. (Location of type: Museum of Comparative Zoology, Cambridge, Massachusetts, type no. 2561.)

Type locality.—The vicinity of the Blue Mountains. (Not restricted further.)

Atractopterus fusiformis LeConte, 1853, Rev. Elat. United States. Trans. American Phil. Soc., Vol. 10, p. 454. Placed as synonym of *Sericus honestus* Randall, 1838, Henshaw, S., 1885, List of the Coleoptera of America, North of Mexico, American Ent. Soc., p. 70.

Type locality.—Lake Superior. (Not restricted further.)

This species is generally larger than other species of *Sericus.* The median length of pronotum is slightly shorter than the median width. The elytra and posterior angles of pronotum are usually decidedly lighter than the disk of the pronotum. The lateral margins of the pronotum are explanate and clearly visible in dorsal view.

Description of species.—Length 12–16.5 mm.; width 3.75–4.5 mm. The body is elongate, moderately convex; elytra, legs, basal segment of antennae and hind angles light reddish brown to yellowish brown; pronotum black, clothed with yellowish pubescence. Eyes prominent, moderately protruding; antennae serrate, slightly shorter than pronotum, second segment larger in diameter than third but shorter, third segment noticeably longer than usual, second plus third longer than fourth, eleventh noticeably dilated centrally, symmetrically tapering to rounded apex.

Pronotum (Plate XVI, Fig. 16) without depressions, median width slightly longer than median length, posterior angles slightly divergent and carinated, lateral margins explanate and clearly visible in dorsal view for entire length and slightly sinuate just anterior to posterior angles, moderately converging anteriorly; moderately punctate with fine umbilicate punctures (Plate XVI, Fig. 17) clothed with long, fine, yellowish setae; interstices approximately twice as large as punctures, obsolete median longitudinal depression. Elytra elongate, gradually tapering, apices conjointly rounded, sutural angles not produced, elytra over two and one-half times

longer than broad, punctation confused, densely clothed with medium yellowish pubescence.

Fifth abdominal sternite with slight basal lateral depressions.

Male genitalia (Plate XVII, Fig. 16) with median lobe narrowly tapering to acute, strongly deflexed apex; chitinized rod moderate, median struts broad and moderately long, lateral lobes tapering, bluntly pointed at apex; setae subapical on external surfaces; basal piece long, one-third as long as median lobe, large unsclerotized U-shaped area.

Distribution.—(Plate XVIII, Map 6.) This species is known from Ontario, New England and northeastern United States.

Specimens examined (34).—*Canada*: **Ontario**, Toronto, 2. *United States:* **Maine**, 2; **New Hampshire**, Herkimer Co., White Mountains, 1, "Mt. Plst. Hse"., 1; **Vermont**, Lamoille Co., Mt. Mansfield, 1, Washington Co., Plainfield, 1; **New York**, Essex Co., Heart Lake, 2, Mt. White Face, 1, Mt. Marcy, Mt. MacIntyre, 1, Greene Co., Catskill, 7, Onteora Mt., 1, Queens Co., White Fish, Long Island, 2, Ulster Co., Slide Mt., 9; **Pennsylvania**, Franklin Co., 1; **Michigan**, Marquette Co., Marquette, 1.

Sericus incongruus (Le Conte, 1853)

Atractopterus incongruus LeConte, 1853, Rev. Elat. United States. Trans. American Phil. Soc., Vol. X, p. 455. (Location of type: Museum of Comparative Zoology, Cambridge, Massachusetts, type no. 2562.)

Type locality.—Lake Superior. (Not restricted further.)

Atractopterus behrensi Candèze, 1889, Elat. Nouv., IV, p. 56. Placed as synonym of *Sericus incongruus* (Linnaeus, 1758), Schwarz, O., 1907, *In* Wytsman, Genera Insectorum, Coleoptera, fam. Elateridae, fasc. 46c, p. 281.

Type locality.—California. (Not restricted further.)

This species differs from other species of *Sericus* in having the following combination of characters: median length of pronotum slightly longer than median width, umbilicate punctures and interstices large and equal in size.

Description of species.—Length 8–9 mm.; width 2–2.5 mm. Body elongate, moderately convex; color ranges from light reddish brown to dark reddish brown, basal segment of antennae and legs lighter than dorsal surface, ventral surface darker; pronounced sexual dimorphism in color pattern; males usually with pronotum black, females with pronotum predominantly reddish brown, with lateral borders from anterior angles to posterior angles and median longitudinal axis black. Eyes prominent, moderately protruding, antennae serrate, extending three-fourths of length of pronotum, second segment larger in diameter than third, but shorter, second plus third shorter than fourth, eleventh apically rounded.

Pronotum (Plate XVI, Fig. 18) without depressions, median length slightly longer than median width, posterior angles strongly carinate, lateral margins slightly sinuate anterior to posterior angles, moderately converging anteriorly, moderately punctate with large umbilicate punctures, interstices approximately equal in size to punctures, clothed with medium yellowish pubescence. Elytra elongate, slightly tapering, sides parallel on basal two-thirds, apices conjointly rounded; almost three times as long as broad, distinctly striated on basal third, less distinct posteriorly; intervals slightly raised, clothed with medium yellowish pubescence.

Male genitalia (Plate XVII, Fig. 17) with median lobe narrowly tapering to acute, strongly deflexed apex; chitinized rod short; lateral lobes slightly expanded apically with stellate, subapical setae on lateral surfaces, base of lateral lobes very broad; wide, rounded basal piece, broad, U-shaped, shallow, unsclerotized area.

Distribution.—(Plate XVIII, Map 6.) This species is recorded from New Hampshire, New York, Michigan, South Dakota, and southern Canada in the provinces of Alberta, British Columbia, and Quebec.

Specimens examined (41).—*United States:* **New Hampshire,** 2, White Mountains, 2; **New York,** Essex Co., Crown Point, 3, Whitefact Mountain, 13, Artist's Brook, 2, Mt. MacIntyre, 2, Indian Falls, Mt. Marcy, 2, Queens Co., White Fish Point, Long Island, 3, Hamilton Co., Long Lake, 2, Warren Co., Warrensburg, 4; **Michigan,** Marquette Co., Marquette, 2; **South Dakota,** Pennington Co., Harney Peak, 1. *Canada:* **Province of Quebec,** 1; **Alberta,** Maligne Lake, 1; **British Columbia,** Terrace, 1.

Sericus silaceus (Say, 1825)

Elater silaceus Say, 1825. Ann. Lyc. Nat. Hist. New York, I, p. 260.

Type locality.—Middle and southern states. (Not restricted further.)

Atractopterus umbraticus LeConte, 1853, Trans. American Philos. Soc. (n.s.), X, Append., p. 505. Placed as synonym of *Sericus silaceus* Say, 1825, LeConte, J. L., 1863, Coleoptera of North America, Smithsonian Mis. Col., Part 1, p. 48.

Type locality.—Middle and southern states. (Not restricted further.)

Sericus flavipennis (Motsch. 1859), Bull. Moscou, Vol. 32(4), p. 383. Placed as synonym of *Sericus silaceus* (Say, 1825), Candèze, E. C., 1863, Mon. Elat., Vol. 4, p. 431.

Type locality.—Cape Drake, northern California.

Sericosomus debilis LeConte, 1859, Proc. Acad. Nat. Sci., Philadelphia, p. 72. Placed as a synonym of *Sericus silaceus* Say, 1825, Candèze, E. C., 1863, Mon. Elat., Vol. 4, p. 431.

Type locality.—Tejon, California.

This species differs from all other species of *Sericus* in having filiform, rather than serrate antennae, and a relatively longer pronotum with large punctures and very small, almost eliminated interstices.

Description of species.—Length 6–8.5 mm.; width 2–2.5 mm. Body very elongate, slightly convex, light yellowish to yellowish brown, pronotum sometimes black, posterior angles, legs and mandibles lighter than dorsal surface of body, ventral surface darker; clothed with light yellowish pubescence. Eyes prominent, markedly protruding; antennae moniliform, extending beyond basal third of elytra, second segment shorter than third, second and third combined considerably shorter than fourth.

Median length of pronotum (Plate XVI, Fig. 20) longer than median width, posterior angles carinate, lateral margins slightly sinuate anterior to posterior angles, sub-parallel, converging very slightly anteriorly, densely, deeply, umbilicately punctate, interstices small, almost eliminated. Elytra elongate, distinctly striated with large punctures, intervals slightly raised, approximately four times as large as striae, gradually tapering, conjointly rounded at apex, sutural angles slightly or not produced, elytra over two and one-half times longer than wide, very densely clothed with medium setae.

Fifth abdominal sternite with lateral subapical depressions.

Male genitalia (Plate XVII, Fig. 18) very slender, median lobe tapering strongly to acute, strongly deflexed apex; lateral lobes with long expanded shoulder, sharp hook on exterior margins below shoulder on apical third, wide rounded basal piece, irregular **U**-shaped unsclerotized area.

Distribution.—(Plate XVIII, Map 6.) This species is generally distributed throughout United States and into Canada.

Specimens examined (531).—*United States:* **New Hampshire,** Belknap Co., Laconia, 1, Hillsboro Co., Pelham, 1, Sullivan Co., Claremont, 1; **Massachusetts,** Hampden Co., Holyoke, 1, Hampshire Co., Amherst, 5, Middlesex Co., Hopkinton, 1, Newton, 6, Sherborn, 2, Wilmington, 2, Suffolk Co., Boston, 5, Worcester Co., Fitchburg, 1; **New York,** Chemung Co., Elmira, 2, Dutchess Co., Poughkeepsie, 3, Essex Co., Crown Point, 5, Nassau Co., Massapequa, 1, New York Co., Central Park, 3, Niagara Co., Olcott, 2, Orange Co., West Point, 17, Rockland Co., Bear Mountain, 4, Suffolk Co., Montank, 2, Wildwood State Park (Long Island), 6, Tompkins Co., Connecticut Hill, 1, Ithaca, 11, West Danby, 2, Washington Co., Whitehall, 12, Westchester Co., Pelham, 1, Wyoming Co., Gainesville, 3, Portageville, 3, Putnam Co., Putnam, 45; **New Jersey,** Bergen Co., Fort Lee, 2, Camden Co., Clementon, 1, Morris Co., Boonton, 1, Passaic Co., Greenwood Lake, 3, **Pennsylvania,** Allegheny Co., 3, Centre Co., State College, 2, Fayette Co., Uniontown, 1, Philadelphia Co., Philadelphia, 1, York Co., Hanover, 1; **Maryland,** Montgomery Co., 2, Prince Georges Co., Bladensburg, 1, Branch-

Table 5. Summation of the comparative characteristics of species of *Sericus*.

Sericus viridanus	*Sericus honestus*	*Sericus brunneus*	*Sericus silaceus*
1. Size 8–11 mm.	1. Size 12–16.5 mm.	1. Size 8–9 mm.	1. Size 6–8 mm.
2. Antennae—serrate, shorter than pronotum	2. Antennae—serrate, shorter than pronotum	2. Antennae—serrate, shorter than pronotum	2. Antennae—filiform, longer than pronotum
3a. Pronotum with depressions	3a. Pronotum without depressions	3a. Pronotum without depressions	3a. Pronotum without depressions
3b. Median length of pronotum less than median width	3b. Median width of pronotum slightly longer than median length	3b. Median length longer than median width	3b. Median length longer than median width
3c. Pronotal punctures large, interstices and punctures approximately equal	3c. Pronotal punctures moderate, interstices approximately twice size of punctures	3c. Pronotal punctures large, interstices and punctures approximately equal	3c. Pronotal punctures large, interstices small, almost eliminated
4. Metacoxal plates almost same size throughout, slightly dilated inwards	4. Metacoxal plates almost same width throughout, slightly dilated inwards	4. Metacoxal plates almost same size throughout, scarcely dilated inwards	4. Metacoxal plates greatly expanded inwards
5a. Male genitalia—short, broad basal piece, seems to fit over base of lateral lobes	5a. Male genitalia—long, slender basal piece	5a. Male genitalia—short, broad basal piece	5a. Male genitalia—wide, rounded basal piece
5b. Shallow, broad, U-shaped unsclerotized area in basal piece	5b. Large, U-shaped unsclerotized area in basal piece	5b. Shallow U-shaped unsclerotized area in basal piece	5b. Moderate irregular U-shaped unsclerotized area in basal piece
6. Lateral lobes expanded with shoulders	6. Lateral lobe long, tapering apically	6. Lateral lobes slightly expanded with stellate setae subapical on lateral surfaces	6. Lateral lobes with long expanded shoulders, sharp hooks on exterior, margin on apical third

ville, 4; **District of Columbia,** Rock Creek Park, 12; **Virginia,** Fairfax Co., Mount Vernon, 2, Spotsylvania Co., Fredericksburg, 2; **North Carolina,** Great Smoky Mountains National Park, 1, Buncombe Co., Asheville, 5, Black Mountain, 7; **Georgia,** Evans Co., Claxton, 1, Rabun Co., Clayton, 1; **Kentucky,** Rockcastle Co., Livingston, 1; **Tennessee,** Gevier Co., Gatlinburg, 1; **Indiana,** 1; **Michigan,** 13; **Wisconsin,** 2; **Oklahoma,** Oklahoma Co., Oklahoma City, 1; **Oregon,** Josephine Co., 15; **California,** Alameda Co., Niles, 2, Oakland, 15, Butte Co., Big Ben Mountain, 2, Calaveras Co., Mokel Hill, 6, Eldorado Co., 2, Fresno Co., 11, Humboldt Co., Green Point, 8, Kern Co., Havilah, 3, Lake Co., Blue Lakes, 5, Kelseyville, 5, Los Angeles Co., Los Angeles, 17, Mount Wilson, 1, Pasadena, 7, Sierra Madre, 4, Madera Co., Ahwahnee, 10, Northford, 12, Marin Co., Fairfax, 15, Lagunitas, 26, Ross, 6, Mariposa Co., Mariposa, 1, Mendocino Co., Hopland, 2, Lickin Fork, 1, Mokelumne River, 3, Yorkville, 1, Yosemite, 1, Napa Co., Napa, 4, Plumas Co., 1, Solano Co., Green Valley Falls, 1, San Francisco Co., 5, San Mateo Co., San Mateo, 1, Santa Clara Co., Almaden, 2, Morgan Hill, 3, Santa Cruz Co., Ben Lomond, 2, Shasta Co., 5, Siskiyou Co., Dunsmuir, 10, Sonoma Co., Sonoma, 3, Trinity Co., Currville, 11, Tulare Co., Kaweah, 4, Sequoia National Park, 50, Alameda Co., Near Sunol, 26. *Canada:* **Quebec,** Montreal, 1.

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LIST OF ABBREVIATIONS

Ant, antenna
b.pc, basal piece
cx, coxa (1, of prothorax; 2, of mesothorax; 3, of metathorax)
E, eye
El, elytron
Eplf, epipleural fold
Epm, epimeron (2, of mesothorax; 3, of metathorax)
Eps, episternum (2, of mesothorax; 3, of metathorax)
Fm, femur
Mnd, mandible
ML, median length of pronotum
MMstS, meso-metasternal suture
Msc, mesosternal cavity
MW, median width of pronotum
MxPlp, maxillary palpus
p, median lobe
PA, posterior angle of pronotum
PE, pronotal epipleura
pm, paramere or lateral lobe
Psp, prosternal process
S1, S3, sternites
Scl, scutellum
Spls, sterno-pleural suture–prosternal suture
St, sternum (1, of prothorax-prosternum; 2, of mesothorax-mesosternum; 3, of metathorax-metasternum)
Tar, tarsus
Tb, tibia
Tn, trochantin
Un, claws

EXPLANATION OF FIGURES

PLATE XV

Fig. 1. Ventral view of *Elater abruptus*.
Fig. 2. Dorsal view of *Elater abruptus*.
Fig. 3. Prosternal suture of *Sericus*.
Fig. 4. Mesosternal cavity of *Parallelostethus*.

Fig. 5. Prosternal process of *Diplostethus*.
Fig. 6. Mesosternal cavity of *Orthostethus*.
Fig. 7. Metacoxal plate of *Elater*.
Fig. 8. Metacoxal plate of *Neotrichophorus*.

Plate XVI

Fig. 1. Pronotum of *Elater ater*.
Fig. 2. Pronotal punctation of *Elater abruptus*.
Fig. 3. Pronotum of *Elater lecontei*.
Fig. 4. Pronotal punctation of *Elater pinguis*.
Fig. 5. Pronotum of *Elater pinguis*.
Fig. 6. Pronotum of *Elater abruptus*.
Fig. 7. Prosternal process of *Diplostethus opacicollis*.
Fig. 8. Pronotum of *Neotrichophorus texanus*.
Fig. 9. Pronotum of *Neotrichophorus carolinensis*.
Fig. 10. Elytra of *Neotrichophorus substriatus*.
Fig. 11. Abdominal punctation of *Neotrichophorus arizonensis*.
Fig. 12. Abdominal punctation of *Neotrichophorus variatus*.
Fig. 13. Mesosternal cavity of *Orthostethus caviceps*.
Fig. 14. Mesosternal cavity of *Orthostethus infuscatus*.
Fig. 15. Pronotum of *Sericus viridanus*.
Fig. 16. Pronotum of *Sericus honestus*.
Fig. 17. Pronotal punctation of *Sericus honestus*.
Fig. 18. Pronotum of *Sericus incongruus*.
Fig. 19. Pronotal punctation of *Sericus incongruus*.
Fig. 20. Pronotum of *Sericus silaceus*.
Fig. 21. Pronotal punctation of *Sericus silaceus*.

Plate XVII

Male genitalia, dorsal view.

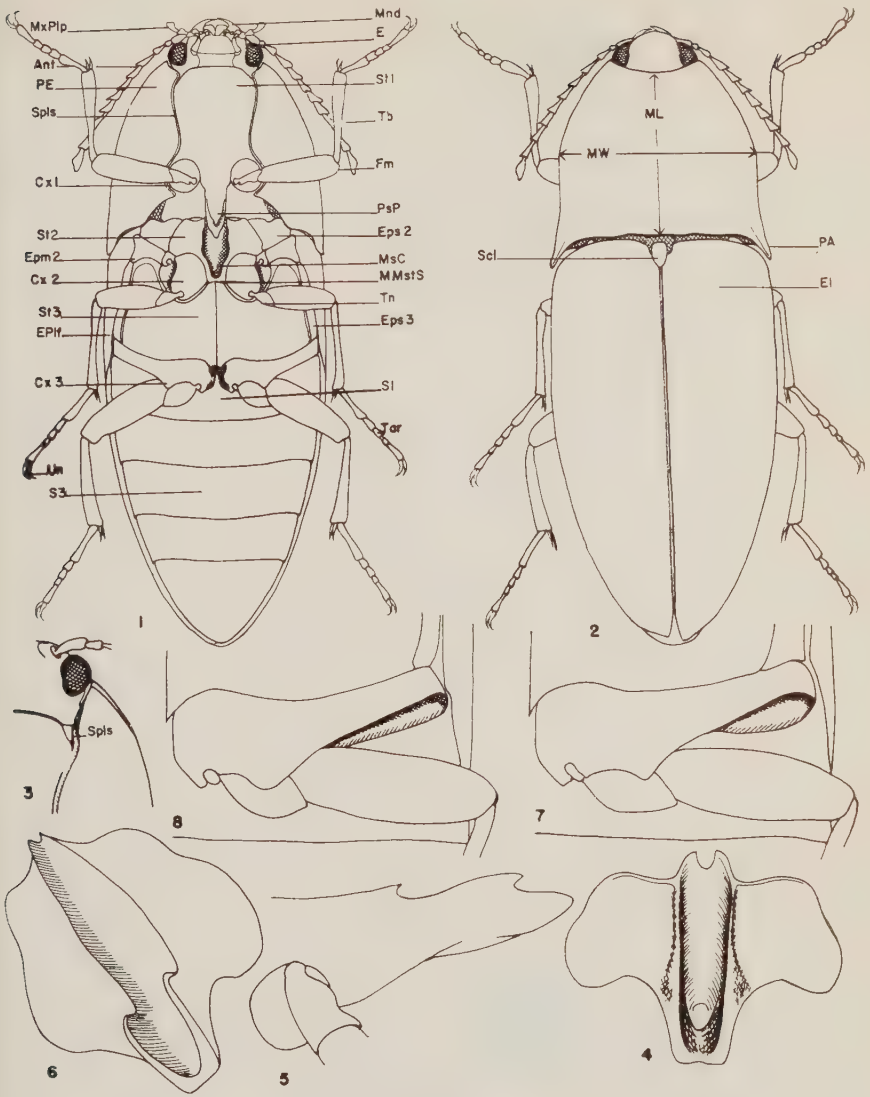
Fig. 1. *Elater ater*.
Fig. 2. *Elater lecontei*.
Fig. 3. *Elater pinguis*.
Fig. 4. *Elater abruptus*.
Fig. 5. *Parallelostethus attenuatus*.
Fig. 6. *Diplostethus peninsularis*.
Fig. 7. *Diplostethus opacicollis*.
Fig. 8. *Neotrichophorus texanus*.
Fig. 9. *Neotrichophorus carolinensis*.
Fig. 10. *Neotrichophorus substriatus*.
Fig. 11. *Neotrichophorus arizonensis*
Fig. 12. *Neotrichophorus variatus*.
Fig. 13. *Orthostethus caviceps*.
Fig. 14. *Orthostethus peninsularis*.
Fig. 15. *Sericus viridanus*.

Fig. 16. *Sericus honestus.*
Fig. 17. *Sericus incongruus.*
Fig. 18. *Sericus silaceus.*

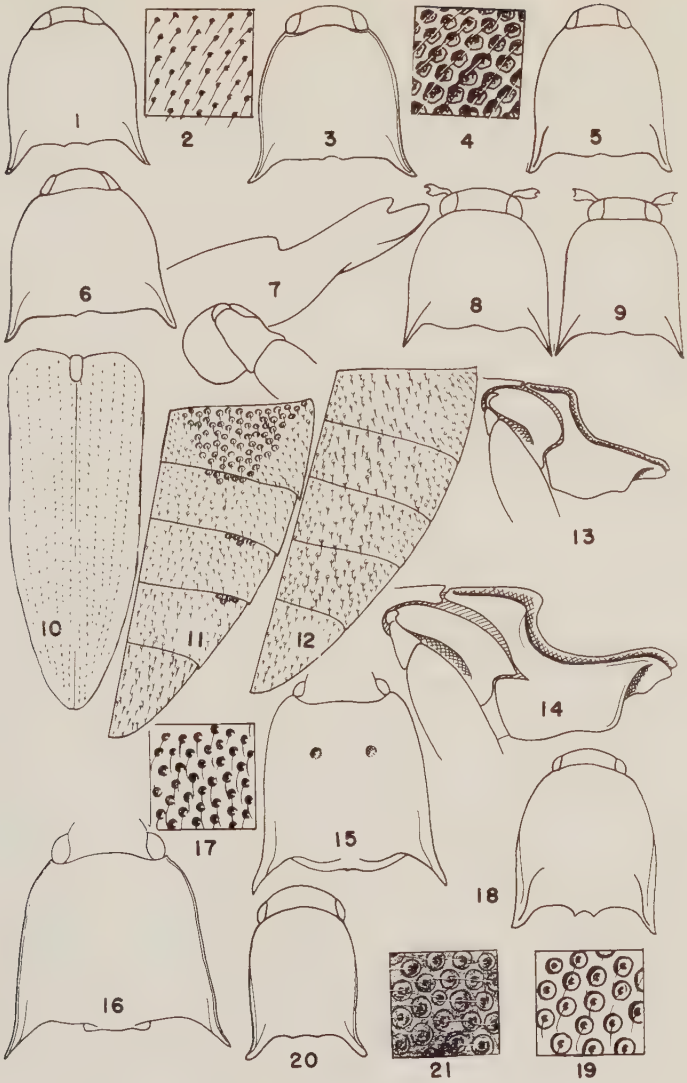
PLATE XVIII

Distribution of species of Elaterini.

Map 1. Species of *Elater.*
Map 2. Species of *Parallelostethus.*
Map 3. Species of *Diplostethus.*
Map 4. Species of *Neotrichophorus.*
Map 5. Species of *Orthostethus.*
Map 6. Species of *Sericus.*



ROACHE: TRIBE ELATERINI



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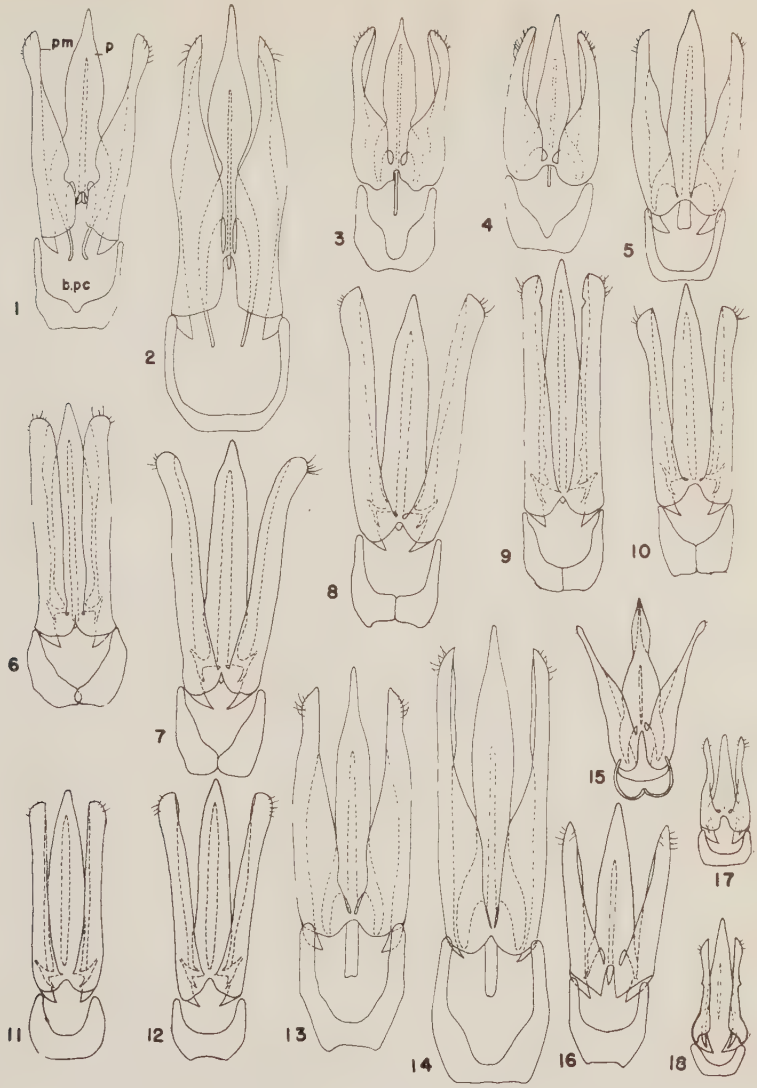

ROACHE: TRIBE ELATERINI

ROACHE: TRIBE ELATERINI

INDEX TO THE GENERA AND SPECIES

New Genera and Species Are Indicated by Bold Face Numerals

abruptus, Elater, 288
Acanthiulus, 6
Acaromimus, 50
Acladocricus, 6
Adelobolus, 6
aeca, Brachymeria (Brachymeria), **242**
Aedokritus, 99
Aimigmabolus, 6
Alcimobolus, 6
aleta, Nilothauma, **101**
Allandrus, 77
Allopocockia, 7
Amblybolus, 7
Amnestostrophus, 7
Anadenobolus, 7
Andocricus, 7
Anelus, 7
anisomorphae, Adelphe, **35**
Apeuthes, 7
Aphistogoniulus, 8
Aporobolus, 8
Araecerus, 50
Araeoderes, 64
Arctobolus, 8
Argentocricus, 8
Arinolus, 8
Arisemus, **8**
arizonensis, Neotricophorus, 303
Arolus, 8
Arostrophus, 8
astax, Cryptochironomus, **97**
ater, Elater, 281
Atopetholus, 9
Atopochetus, 9
Atoposega, **33**
Attemsobolus, 9
attenuatus, Parallelostethus, 293
Aulacobolus, 9
Austrocaenis, 200
Auxobolus, 9
Aztecolus, 9
Azygobolus, 9

Banosolus, 9
Barrobolus, 9
belfragei, Brachymeria (Brachymeria), 237
bella, Microsega, **32**
Brachycercus, 202
Brachymeria, 228, 229
Brachyspirobolus, 9
breda, Calopsectra, **103**
Brevibarra, 67
Bukobolus, 10

Caenis, 200
Caenodes, 198
Caenomedea, **199**
Cairibolus, 10
Californibolus, 10
Callipodolus, 11
Calopsectra, 103
cantus, Cricotopus, **92**
Cardiocladius, 87
carinatifrons, Brachymeria (Brachymeria), 248
carolinensis, Neotricophorus, 301
caviceps, Orthostethus, 307
Centrelus, 11
Centrobolus, 11
Chelogonobolus, 11
Chersastus, 11
Chicobolus, 11
Choragus, 51
Cingalobolus, 11
Cladiscocricus, 12
claripalpis, Paratheresia, 217
coloradensis, Brachymeria (Brachymeria), 250
columbiana, Brachymeria (Pseudobrachymeria), 266

comitator, Brachymeria (Brachymeria), 257
comma comma, Melinaea, 163
comma isocomma, Melinaea, 162
comma, Melinaea, 162
comma simulator, Melinaea, **162**
compsilurae, Brachymeria (Brachymeria), 247
conica, Brachymeria (Pseudobrachymeria), 270
Cricotopus, 89
Cryptochironomus, 96
Cubobolus, 12
Cubocricus, 12
Cyclothyrophorus, 12

Decelus, **12**
Dekanbolus, 12
Desmocricellus, 12
Desmocricus, 12
diadema, Stomatodexia, 214
Diaphoropus, 12
diatraeae, Lixophaga, 209
Dinematocricus, 13
Diplostethus, 295
Discotenes, 54
discreta, Brachymeria (Gahanula), 262
discretoidea, Brachymeria (Gahanula), 263
duena, Nilothauma, **101**

egina agricola, Melinaea, 142
egina egina, Melinaea, 140
egina manuelito, Melinaea, 141
egina, Melinaea, 139
egina paraiya, Melinaea, 141
Elater, 279
eleanatis, Cricotopus, **94**
Epibolus, **13**
Epitrigoniulus, 13
Epombrophilus, 13
Erythroprosopon, 13
ethra, Melinaea, 133
Eucarlia, 13
Eucentrobolus, 13
Eugonus, 61
Euparius, 56
Eurelus, 13
Eurhinocricus, 13
Euxenulus, **53**
Euxenus, 52
evansi, Mesitiopterus, **30**

flegiae, Brachymeria (Pseudobrachymeria), **271**
Florianus, **13**
floridensis, Mesitiopterus, **28**
Floridobolus, 14
fonscolombei, Brachymeria (Brachymeria), 238

Gahanula, **261**
Glosselus, 14
Gonauchenius, **14**
Goniocloeus, 72
Gosichelus, 14
Guamobolus, 14
Gymnognathus, 74

Hadrobolus, 14
hammari, Brachymeria (Brachymeria), 244
Hesperolus, 14
Hiltonius, 15
honestus, Sericus, 314
Howeobolus, 15

idae idae, Melinaea, 138
idae, Melinaea, 138
idae vespertina, Melinaea, 139
incerta, Brachymeria (Brachymeria), 253
Incobolus, 15
incongruus, Sericus, 315
infuscatus, Orthostethus, 308
intermedia, Brachymeria (Brachymeria), 249
Ischnocerus, 55

Javolus, 15

kahlii, Mesitiopterus, 27
komphobolus, 15

laetiliae, Brachymeria (Pseudobrachymeria), **268**
Lankabolus, 15
lecontei, Elater, 283
Leiocricus, 15
Leptogoniulus, 15
lilis dodona, Melinaea, 133
lilis erica, Melinaea, 133
lilis ezra, Melinaea, 130
lilis flavicans, Melinaea, 128
lilis imitata, Melinaea, 129
lilis lilis, Melinaea, 131
lilis, Melinaea, 127
lilis messatis, Melinaea, 132
lilis parallelis, Melinaea, 130
lilis sola, Melinaea, 131
Lissocricus, 15
Litobolus, 15
Litostrophus, 16
lucifer eryx, Melinaea, 166
lucifer lucifer, Melinaea, 164
lucifer lutzi, Melinaea, 165
lucifer, Melinaea, 165

maelus brunnea, Melinaea, 144
maelus cydon, Melinaea, 144
maelus madeira, Melinaea, 143
maelus maelus, Melinaea, 145
maelus mayi, Melinaea, 144
maelus, Melinaea, 142
maelus purusana, Melinaea, 143
maenius cocana, Melinaea, 154
maenius hicetas, Melinaea, 153
maenius juruaensis, Melinaea, 154
maenius maenius, Melinaea, 153
maenius, Melinaea, 152
maenius pothete, Melinaea, 154
maenius tarapotensis, Melinaea, 154
maeonis borealis, Melinaea, 146
maeonis maeonis, Melinaea, 146
maeonis, Melinaea, 146
maeonis zamora, Melinaea, 147
marsaeus clara, Melinaea, 151
marsaeus egesta, Melinaea, 149
marsaeus macaria, Melinaea, 150
marsaeus marsaeus, Melinaea, 149
marsaeus, Melinaea, 147
marsaeus rileyi, Melinaea, 150
Marshallbolus, 16
Mauritobolus, 16
Melinaea, 110
menophilus, Melinaea, 155
menophilus menophilus, Melinaea, 155
menophilus orestes, Melinaea, 158
menophilus zaneka, Melinaea, 156
Messicobolus, 16
Metacricus, 16
Metiche, 16
mexicana, Adelphe, 33
mexicana, Brachymeria (Brachymeria), 240
Microsega, **31**
Microspirobolus, 17
minense, Metagonistylum, 212
mneme, Melinaea, 124
mnemopsis, Melinaea, 142
molestae, Brachymeria (Brachymeria), **245**
mothone, Melinaea, 158
mothone messenina, Melinaea, 159
mothone mothone, Melinaea, 159
Mystalides, 17

nalus, Cricotopus, **89**
Narceus, 17
Neocricus, 17
Neotricophorus, 298
Neptunobolus, 17
Nesobolus, 17
Nilothauma, 100

Onychelus, 17
opacicollis, Diplostethus, 297
Opheocricus, 17

Ormiscus, 62
Orthichelus, 18
Orthostethus, 306
ovata, Brachymeria (Brachymeria), 258
Oxobolus, 18
Oxypyge, 18
Oxypygides, 18

Pachybolus, 18
Parallelostethus, 289
Paraspirobolus, 18
pedalis, Brachymeria (Pseudobrachymeria), 264
pela, Calopsectra, **105**
peninsularis, Diplostethus, 296
Pentocricus, 18
Perucricus, 18
Phaenithon, 60
Phagostrophus, 18
phasiana magna, Melinaea, 151
phasiana, Melinaea, 151
phasiana phasiana, Melinaea, 152
Phoenicobiella, 64
Physobolus, 18
Piedolus, 19
Piesocorynus, 69
pinguis, Elater, 286
Plokamostrophus, 19
Polybunobolus, 19
Polyconoceras, 19
Poratobolus, 19
Prionopeza, 19
Proporobolus, 19
Prospirobolus, 20
Pseudobrachymeria, **263**
Pseudochironomus, 98
Pseudospirobolellus, 20
psyche, Brachymeria (Pseudobrachymeria), **267**
Pygodon, 20

Queenslandobolus, 20

Rhexenor, 20
Rhinocricus, 20
Rhytidocricus, 20
robusta, Brachymeria (Brachymeria), 255
rubrum, Cricotopus, **96**
russelli, Brachymeria (Brachymeria), **240**

Saipanella, 21
Salpidobolus, 21
sartis, Aedokritus, **100**
satevis aurantia, Melinaea, 138
satevis crameri, Melinaea, 137
satevis, Melinaea, 136
satevis satevis, Melinaea, 136
Saussurobolus, 21
Schmidtolus, 21
Scobinomus, 21
scylax, Melinaea, 135
Sechellobolus, 21
Sericus, 310
setis, Cricotopus, **93**
silaceus, Sericus, 316
Sinobolus, 21
slossonae, Brachymeria (Brachymeria), 252
Spirobolellus, 22
Spirobolinus, 22
Spirobolus, 22
Spiromanes, 22
Spiromimus, 22
Spirostrophus, 22
Stenobolus, 22
Stenocerus, 75
Strophobolus, 23
substriatus, Neotricophorus, 302
Sumatrobolus, 23
Sympastrophus, 23

Tarascolus, 23
Tasmanocoenis, 202
tegularis, Brachymeria (Brachymeria), 232
texanus, Neotricophorus, 300
thera eratosthenes, Melinaea, 164

thera, Melinaea, 164
thera thera, Melinaea, 164
Thrinciulus, 26
Thyroproctus, 23
Tidolus, 23
Titsonobolus, 23
Toltecolus, 23
Tonkinbolus, 23
townsendi, Mesitiopterus, 28
Toxonotus, 65
Trachelomegalus, 23
Trachyrhinus, 24
Trachytropis, 73
travassosi, Cardiocladius, 87
Trigoniulus, 24
Trigonorhinus, 58
Tropideres, 70
Trucobolus, 24
truncata, Brachymeria (Brachymeria), **234**
Tylobolus, 24

variatus, Neotricophorus, 304
Variulus, 24
viridanus, Sericus, 313
viridis, Pseudochironomus, 98

Walesbolus, 24
Watichelus, 24
weemsi, Brachymeria (Brachymeria), **236**

Xenobolus, 25

Yucatobolus, 25

Zipyge, 25
zuelis, Cricotopus, **93**
Zygostrophus, 25

61/2Re